Volume 60

American Machinist

New York, April 17, 1924

Number 16

How to Estimate Machine Shop Costs

By Albert A. Dowd

The first article of a series on the subject — Various classes of work covered — Value of accurate estimates — Organization and operation of an estimating department

REALIZING the lack of information with respect to methods used in estimating costs of machine work, and in view of the importance of the matter as applied to all branches of mechanical work, it seems reasonable to assume that a series of practical articles on the subject should be of vital interest in the mechanical industries. The estimating of costs covers a wide field of endeavor and it is not easy to separate the material under distinct headings, due to the fact that there are no very strong lines of demarcation between the different groups or classes of work that must be given consideration.

There are a number of things to consider when making an estimate of cost for any particular kind of work, yet many of the same points must be thought of, no matter what particular variety is in question. In order to establish a basis upon which to work and to make clear to the reader the scope of this series of articles, it is the intention of the writer to describe the methods used in estimating costs for the following classes of work:

1—Production work
2—Tools
3—Gages
4—Special and automatic machinery
5—Repair work
6—Jobbing work in small lots
7—Drafting room work.

While some of these are very closely allied, there are points of difference which seriously affect the costs of the different classes of work. These will be pointed out and illustrated by means of specific examples during the progress of the series.

Mechanical work consists primarily of labor hours as applied to machine tools and workmen, but when estimating costs, many other factors must also be taken into consideration. Not only the labor costs in the shop, but also other labor in the line of preparatory work, tool design, planning, supervision, etc., must be included and given attention. The machine shop may be divided into a number of departments in which the various operations, such as drilling, milling, planing, turning, boring, broaching, etc., are performed, or the shop may be so arranged that many of these operations are done in the same department. The operation of the machine tool is the same, however, no matter whether it stands in a department with many other types or whether it is in a group of machines of the same general type.

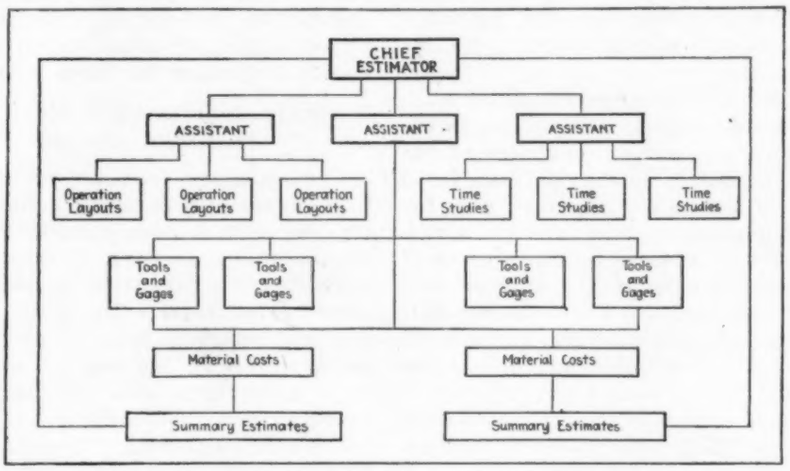


Fig. 1—Organization chart for estimating department

There is considerable difference between rendering a bill to a customer after the work has been completed, and giving him the estimated cost of the work before anything has been done on it. In one case it is only necessary for the manufacturer to look over his cost records for material, labor, etc., and then add the overhead expense together with an allowance for profit. In the other case the cost of labor, materials, overhead expense, and profit, must first be carefully estimated and a price rendered in accordance therewith. If the

estimated cost is too great, either when considered by the prospective customer, or by comparison with other prices for the same work as quoted by other manufacturers, the factory suffers from a lack of orders. On the other hand, if the prices quoted are too low, the order must be handled at a loss or, at least, with too small a margin of profit.

Importance of Correct Estimates

In the manufacture of mechanical devices, such as machine tools, automobiles, fire-arms, sewing machines, typewriters, special machinery, jigs, fixtures, gages, punches and dies, etc., every item connected with the cost must be very carefully estimated before the work is done, and an accurate record of actual costs must be kept during the process of manufacture. The matter of correct estimate is of such importance to executives throughout the country, and to all manufacturers who are called upon to submit quotations for various kinds of work in competition with others, that it is the intention of the writer to cover as great a variety of work as possible and, at the same time, to illustrate by means of specific examples, the problems with which the estimator is continually confronted.

The reader should understand the fundamental nature of the information given and realize the writer's purpose in thus presenting the data. If any other method were to be used, and an attempt made to cover the general subject of estimating costs, the amount of material necessary would be prohibitive and, even then, its value would be problematical, since there are such a great number of branches to the subject. By confining ourselves to the estimating of machine costs in general, we shall avoid deviations into other territory, yet much of the information presented will be found applicable to different kinds of work.

One of the most important matters connected with the establishment of an estimating department, is the selection of the right man to whom the charge of the work will be given. A thoroughly capable man for a position of this sort is not picked up every day, for the requirements are unusually severe, and the necessary knowledge can only be obtained by many years of actual shop experience. The ability to analyze shop problems and to apply his practical knowledge to their solution, is an indispensable qualification. The general nature of the work on which estimates are to be made must also be considered for, on some highly specialized manufacturing, the chief estimator should have a thorough knowledge of the particular product together with the best methods for its manufacture.

Organization of the Estimating Department

The size of the factory, the number of men employed, the machine tool equipment, and the character of the work usually manufactured, are all factors which influence the organization of the estimating department and its co-ordination with other departments. Whether it is large or small, there must always be a spirit of co-operation between this department and the shop itself, if satisfactory results are to be obtained. The greatest economies in manufacture are only obtained by careful and accurate work in all departments, capable supervision, and a harmonious feeling among executives and men.

In laying out an organization chart for the estimating department, there are many factors to be considered and, as these vary according to size of factory, kind of work, and general system, it is difficult to give a specific organization as an example which will prove serviceable for various factories. The planning department, cost department and engineering department are often very closely associated with the estimating department, but the general chart, shown in Fig. 1, is purposely made self-contained, in order to avoid complications with other departments.

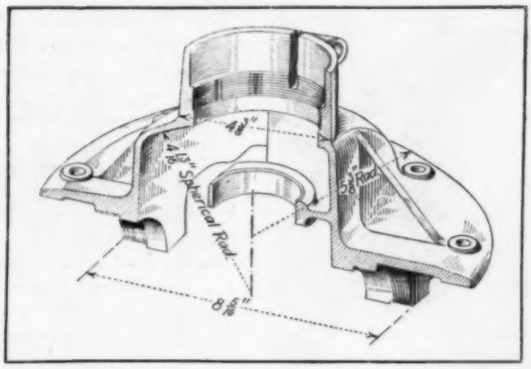
Perhaps the easiest way to explain the chart is to specify briefly the duties of the various men in estimating the cost of manufacturing a given piece of mechanism, such as a transmission gear case unit, complete with gears and shafts. We will assume the unit to be manufactured in lots of 5,000 or more, and the first step is a conference between the chief estimator and his assistants. At this conference a rough analysis of the work is made to make sure that it can be handled to advantage with the factory machine equipment, and the most suitable general methods, the tools and gages required, and other pertinent matters are discussed. In many cases the chief estimator takes it on his own shoulders to decide whether the work can be handled profitably or not and, in this case, there is a conference upon the general methods of handling certain parts. The assistants may then select some of the blueprints and make rough drafts of necessary operations, talking matters over with the operation layont men, the time study men, and the tool and gage men. These men lay out the operations, list the tools and gages needed, specify the types of machines used, and figure the time necessary for the work. Rough sketches of tools and gages are also made, together with estimates of costs. The materials required are looked up and figured out, and the summary of all the items involved is carefully made, by the members of the organization designated for these purposes.

Estimate Requirements Must Be Followed by the Planning and Cost Departments

The summary estimate contains totals of all labor, tools, gages and materials needed for the entire work, together with recommendations regarding the purchase of new machines tools, if these are required. When completed, the data is all turned over to the chief estimator, who inspects the work and gives it the final approval before turning it over to the sales or cost department. In the case of contract work, the sales department then adds the percentages required for overhead and profit allowances, and makes the quotation to the customer. When the order is received, the planning department and estimating department confer regarding the requirements of the work and follow out as far as possible the original ideas on which the estimated prices are based. The cost department establishes the piecework prices according to the estimate, and it only remains for the factory to prove that the estimator understands his business.

This, briefly stated, is the method used in estimating prices for contract work. Success or failure is dependent upon the accuracy of the estimate and the co-operation of the shop after the order has been received. Without earnest co-operation and careful supervision, it is easy for a firm to be almost ruined by putting through a contract at a tremendous loss of time and money. The estimating department might be blamed for the loss when, in reality, the fault is often entirely due to poor supervision and neglect in the factory itself, factors beyond the control of the estimator.

THE differential carrier is a most important member of the rear axle assembly. For while the differential itself may be called the heart of the rear axle, the heart cannot function properly unless it is rigidly supported and held in proper alignment by the carrier. For this reason the utmost care is taken to have special fixtures, that insure accuracy and are readily handled. The carrier itself is shown herewith.



Maxwell Methods of Making Rear Axle Parts

By Fred H. Colvin
Editor, *American Machinist*

Second article — An elliptical facing device — Drilling, boring and reaming fixtures—Inspection gages, and the running-in of the complete rear end

A FREE running rear axle depends to a great extent upon the alignment of the driving shaft, differential gear housing, and the axle itself. The alignment of these elements depends largely upon the accuracy of the fixtures in which the work is done and the way in which they are maintained. The fixtures used in the Maxwell plant have been designed with a view to rigidity and, at the same time, so as to be readily handled. Some of the fixtures are shown in the accompanying illustrations.

One of the first operations is to face the flange of the carrier as a point, or surface, from which to locate the piece in future operations. Instead of milling this surface with a profiling cutter, as is frequently done, the Maxwell method is to turn it, as shown in Fig. 10. The carrier is centered on a mandrel and drawn back by the nut *A* on the central bolt. The edge is supported by spring plungers which can be locked in place by side screws as at *B*. As the somewhat elliptical contour prevents regular turning, the tool is controlled by the cam at *C*. This attachment, as will be noted, is very rigidly designed and enables the work to be done accurately and rapidly.

Rough Boring Main Carrier Bearings

The battery of machines shown in Fig. 11 are for rough boring the main bearings in the differential carrier. The machine at the left was left empty to show its construction and the way in which the boring bar is guided at its lower end. As this is an indexing fixture, the same center-guide *A*, acts for the bar in both positions. The upper guide-bushing floats on the boring bar, so that it is always in position no matter which side of the fixture is uppermost.

The hole is bored while a 0.003-in. shim is clamped between the cap and the carrier. The tolerance is 0.001 in. plus; the unilateral system being used.

The way in which the carrier is held is shown at *B*. It is slipped over the central stud, the double-handled bushing *C* fits over the stud and into the end of the carrier, the slip washer goes inside the nut, and the carrier is held firmly and can be put into position rapidly. Each fixture is mounted on a substantial base, or truck, with four wheels, and locates and guides the work from spindle to spindle. The track is a fairly heavy casting, tied together at intervals by the cross rods shown. The battery of machines is supplied with cutting compound from a single pump, which is located just behind the Baker drilling machines. The whole battery is surrounded with a low concrete wall, which encloses the track as well, so that the compound can be used freely without splashing over the floor.

Line Reaming Fixture

To insure accuracy of the bearing seats in the finished carrier, the line reaming fixture shown in Fig. 12 is used. The carrier is centered on a central stud and positioned by the pin *A*, through one of the bolt holes in the flange. Then the floating clamps *B* grip the lug at the base. The reaming bar is supported in large bearings and driven by a small special headstock at the left. Although hardly visible in the illustration, there is a fly cutter on each reamer head, which cuts just ahead of the reamer itself. In this way each hole is sized by the fly cutter, so that the reamer always removes the same amount from each hole, and thus maintains the size of the reamed hole very easily. The tolerance of the line reaming is only 0.0005 in., which is made possible by this method of final reaming.

The complete set of gages used in inspecting the

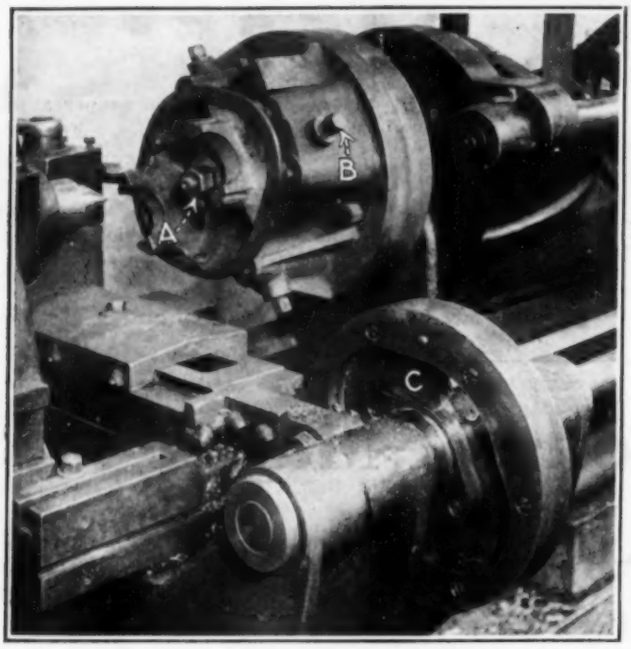


Fig. 10—Turning the face of the flange

differential carrier is shown in Fig. 13. The carrier is mounted on the central stud *A* and the test bar *B* put through the bearing seats. The dial gage *C* tests the squareness of the bar *B* with the plug *A*, while the micrometer *D* measures the location of the center lines of both *A* and *B*. The micrometer head is fixed in the swinging arm *E*, which is fixed on the surface plate with relation to the stud *A*. Swinging the carrier half way round makes a second check on this alignment.

The column at the left has a hardened and ground pin inserted in it on the same center line as the test bar. This is used as a stop to locate the bar at exactly 90 deg. to the center line of the micrometer barrel.

A knife-edge feeler gage, with steps varying by 0.001 in., is used to check the alignment of the flange with the test bar.

The case which carries the differential gears must also be accurate if the gears are to run smoothly and quietly. The fixture for finishing the drive-gear fit is shown in Fig. 14. The case is held in a substantial cradle, and held in place by the latch shown at *A*. The cradle swings on trunnions and is indexed by the the latch *B*. The sizing reamer *C*, is shown just entering the hole for the drive-shaft bearing.

Double Fixture for Drilling the Flange

For drilling the eight holes in the flange of the case, two fixtures are mounted on a turntable, as shown in Fig. 15. The drill bushings are held in the swinging lid, which is latched by the button. The turntable allows one fixture to be drilled while the other is being loaded, so that the result is practically continuous drilling.

The differential pinions have a spherical face at the back, which bears on a mating face in the case itself. The curved face is finished by the use of reamers such as shown in Fig. 16. One is in place on the bar at *A* and another lying on top of the case at *B*. The case is located in the fixture by the drive pinion end, and held in position by the plate *C*, by means of a swinging bolt.

Road testing for noise is not feasible when the daily production runs up into the hundreds. So the complete differential is tested on the stand shown in Fig. 17, which is located in a quiet room to eliminate other noises. Instead of testing the completed axles, the differential, mounted in its carrier, is placed in the fixture shown, which is in reality a sort of dummy axle. The carrier is located by the two dowels *A* and *B*, and

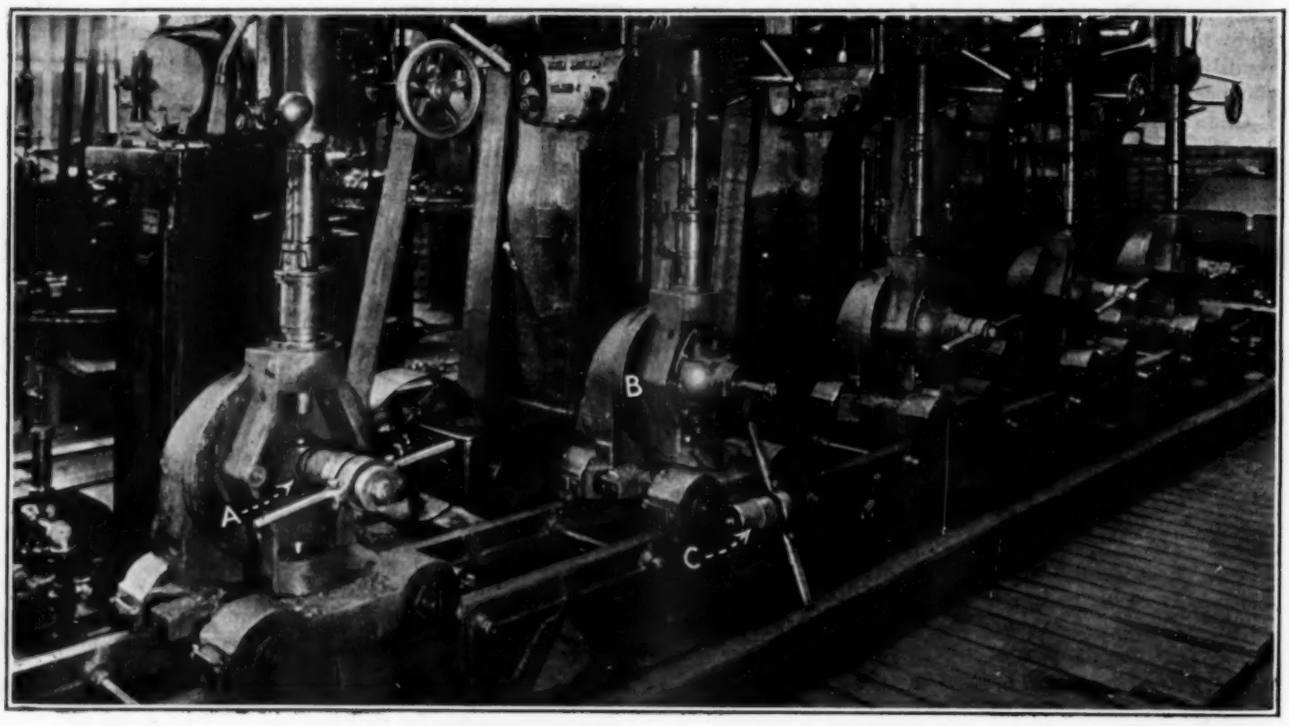
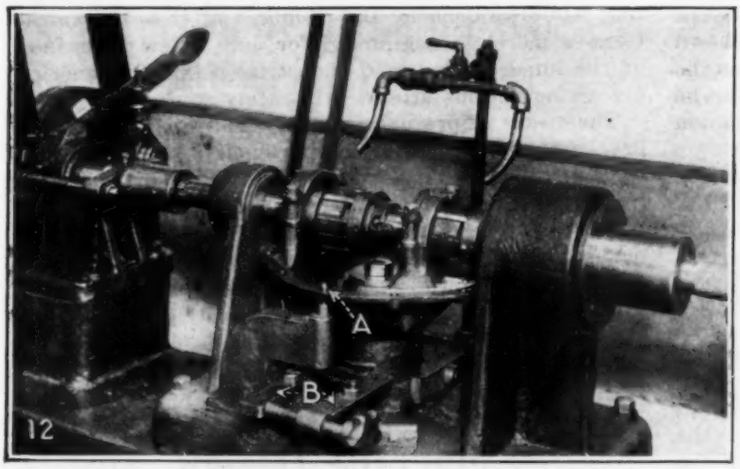
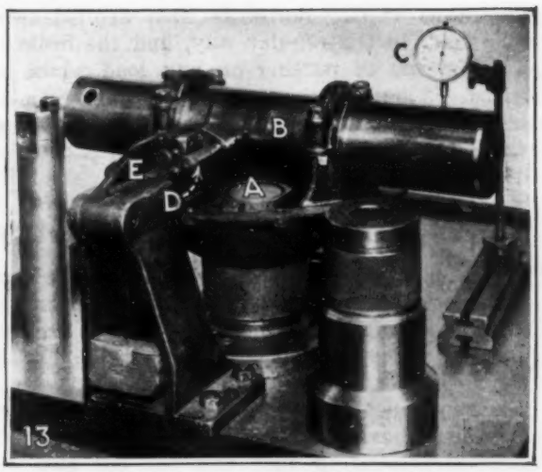
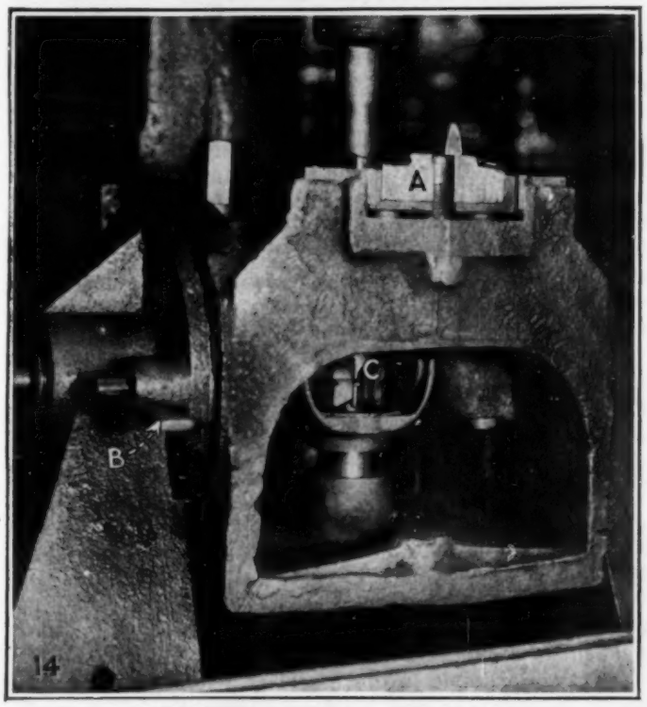
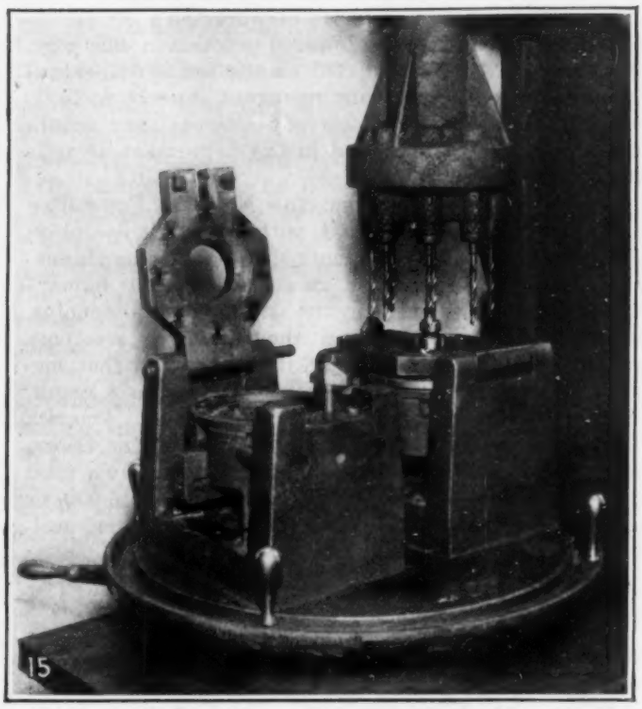


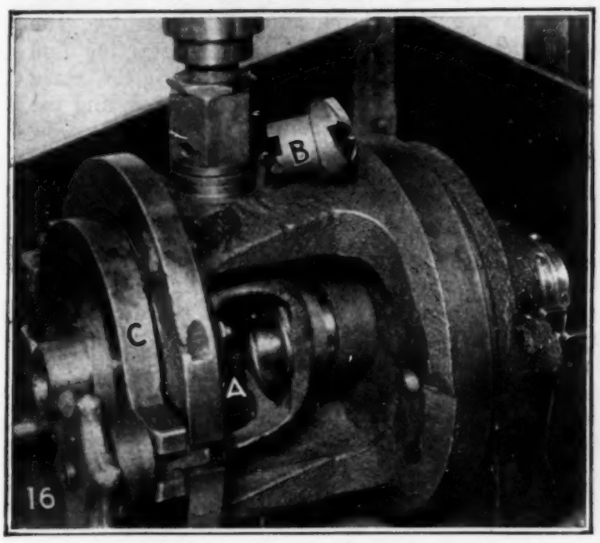
Fig. 11—Rough boring carriers for main bearings











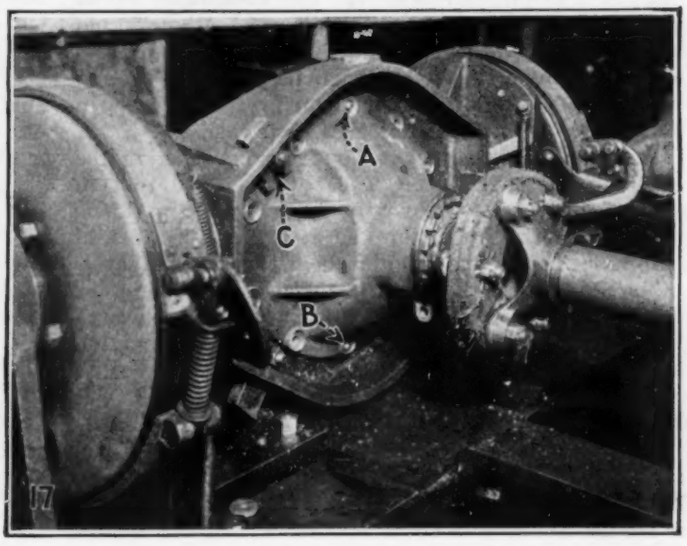


Fig. 12—Special line reaming machine. Fig. 13—Gages and methods of testing. Fig. 14—Reaming drive pinion bearing. Fig. 15—Drilling flange holes. Fig. 16—Finishing spherical seat for pinions. Fig. 17—Final running-in test

clamped as at *C*. Power is then applied through a drive shaft in the regular way, and the brakes shown give a means of putting on any load which may be desired. This device enables the differentials to be handled quickly and given as severe a test as occasion demands.

Eye Hazards of Industry

THE report of a two-year study of the eye hazards of industrial occupations is to be issued in the near future by the National Committee for the Prevention of Blindness, whose headquarters are at 130 E. 22nd St., New York City.

The report deals not only with the causes of accidental and other injuries to the eyes of employees and the means of preventing such injuries, but also with the cost of these injuries in terms of workmen's compensation, medical expense, and lowered production efficiency. The report will be distributed among industrial executives, safety engineers, plant managers, superintendents, foremen, engineering schools and colleges, and others responsible for or interested in the prevention of accidents in factories.

In publishing this volume the National Committee calls attention to the fact that, with the single exception of fatal accidents, eye accidents surpass all other industrial hazards in seriousness, measured from the humanitarian, the cost sheet, or the production standpoint. Approximately two hundred thousand eye accidents occur in industry annually, and it is estimated that several thousand eyes are permanently blinded as a result. There is hardly an industrial occupation in America which does not add annually to the steadily increasing total of the industrial blind and near blind. Of a total of 100,000 blind persons in the United States, 15,000, or nearly one-seventh, became so through industrial accidents.

Dangerous Instruments

The report contains photographs of pocket-knives, nail files, and small shop tools that have been used by workmen to remove cinders and other foreign bodies from the eyes of their fellows. The Committee found that in many plants employees still use toothpicks, old matches, dirty pocket handkerchiefs, and sometimes even their tongues to remove particles from the eyes of their fellow workers, and that such practices result in the total loss of hundreds of eyes each year.

The situation, however, is far from hopeless, in the opinion of the committee. The study showed that in many of the larger industrial properties remarkable reductions in the frequency and severity of accidental eye injuries have been brought about through the introduction of protective devices, through campaigns of safety education of employees, and particularly through training workmen to seek medical or surgical attention for eye injuries rather than permit fellow workmen to attempt to remove foreign particles from their eyes with whatever happens to be handy.

The activities of such organizations as the National Safety Council, the American Museum of Safety in New York City, the American Society of Safety Engineers, the United States Bureau of Standards, and the American Engineering Standards Committee have contributed much toward the elimination of the eye hazards of industrial occupations, the committee found, but "all that has been done by the members of these organizations is merely a beginning, for only a few thousands of the hundred thousand industrial plants in America are giving serious attention to safety work."

The means of preventing injury and infection of eyes developed by the safety departments of the United States Steel Corp., the Pullman Co., the General Electric Co., the Ford Motor Co., the du Pont companies, and a number of other large industrial plants, are recommended to all employers in this report. The methods which have been developed by these and other organizations at a cost of millions of dollars are now available for the smallest plant, the committee says.

Increasing Use of Clutches in Machine Design

By S. H. Simon
Vice-President, Carlyle Johnson Machine Co.

THE *American Machinist* has pointed out from time to time certain tendencies in machine design. A noteworthy fact at present, in connection with the machine tool industry, is the large number of machines of entirely new design that are constantly being placed on the market. Equally noticeable is the growing number of these machines incorporating the use of clutches. It seems to me that this tendency toward increased use of clutches has not been sufficiently emphasized in your publication.

Let me point out a few examples of clutch-equipped machines introduced within the past two years. The Colburn Machine Tool Co., Cleveland, one of the plants of the Consolidated Machine Tool Corp. of America, uses six clutches on each of its heavy duty boring mills. The multiple spindle spline hobbing machine just placed on the market by the Sommer & Adams Co. of Cleveland, Ohio, makes use of eight clutches. On this machine each clutch is operated by its own handle in transmitting power from the driving pinion, making possible the starting and stopping of each unit independent of any other.

Another example is the model C 5-spindle automatic screw machine of the National Acme Co., Cleveland, Ohio. There are two clutches on this machine, one located on the worm shaft to control the starting and stopping of that shaft and thereby govern the main shaft on which the main cam drums are located, and the other on the clutch shaft to control the fast and slow motions of the machine.

Machines Use Several Clutches

On the Betts 100-in. double-drive vertical boring mill there are two friction clutches located one on each side of the machine back of the cross-rail and used for reversing the feed and for rapid power traverse. The Blanchard 27-R vertical surface grinder employs a double clutch to provide for rapid raising or lowering of the tool and a similar clutch to provide power for traversing the chuck from the loading to the grinding position and return. There is also on this machine a single clutch located in the gear box and acting to rotate the table.

There are numerous other installations of clutches on machine tools as a search of your Shop Equipment News section would show. The ones I have mentioned are those with which I happen to be the most familiar.

Pertinent Ideas on the Cutting of Threads

By H. R. Fowler

IN THE past few years we have all been learning a little more than we thought we knew about screw threads. New ways have been developed for accurately and commercially measuring the lead and locating errors; taps are now ground after hardening to correct any errors that may develop; and even the die chasers are now ground by one maker, at least up to ⅝ in. in diameter.

We have been taught, and have had demonstrated to us, that a piece of cold-rolled steel threaded up for an inch or two, and upon which a nut that has only a 50 per cent thread is screwed, will stretch under tension and break in two without injuring the thread in the nut in the least. In other words, half of the thread in the part which is tapped out can be done away with and the part will be still stronger than the bolt itself. I didn't believe it either until one of the big tap makers demonstrated it to me. The National Screw Thread Commission tells us that even with only a 43 per cent depth of thread, and in aluminum at that, a ⅝-in. stud will break off before the thread will give way.

Tap Breakage Decreased by the Use of a Larger Tap Drill

We had a job in the shop on which we were using ⅝-in. U. S. S. ground taps, and the tap breakage was getting serious. We at first condemned the taps for being too hard, but it occurred to us, finally, to figure up what percentage of thread we were cutting, and the result—92 per cent—opened our eyes. We then used a larger drill, so as to get about a 60 per cent thread, and we found our tap breakage dropped 90 per cent. That is worth while, especially when you consider that the cost of the tap is not the only item, as getting out the broken tap is sometimes a soul-harrowing experience.

The more we went into the subject, the more interesting it became. We machine-tap all sizes from ¼-in. to 5-in. in steel and cast iron, and have found it very profitable to go over all the sizes, and increase the amount of clearance, so as to have about 60 to 65 per cent thread left. In several cases where we were stripping threads occasionally in tapping cast iron, we found the 60 per cent thread cured the trouble. The trouble with a great many people is that, in spite of the recommendations of the Screw Commission and the advice of tap manufacturers, they are afraid to make such a radical change in their methods.

Deficiencies of Tap Drill Lists

Small tool makers often place various reference tables in the back pages of their catalogs, including "Size of Tap Drills." These have in most cases been copied bodily from some handbook that was published years ago, and the "Sizes" were established when people had more time to nurse a tap through a hole than we think we have now. Most of the sizes given are too uncomfortably close to 100 per cent thread to be at all practical for commercial work. I have seen very few such tables that were of any use except to dress up a catalog. If they would give a list of drills for various percentages of thread, say 50, 60, and 75 per cent, and let the customer take his pick, they would have something worth while.

About twelve years ago, Mr. F. O. Wells of Greenfield, Mass., read a paper before the A.S.M.E. advocating not over 75 per cent thread, and his conclusions were arrived at after very exhaustive tests. In fact, I believe it is an old story to many tap and gage makers, but the difficulty of educating the public is pretty well known to them and the path of least resistance is to give a customer what he asks for. In conversation with a gage manufacturer recently, one who specializes in a roll type of thread gage, he told of one of the largest concerns in the country, and one that is usually in the front rank in research work, ordering gages from him. This company insisted on close tolerances, top, bottom ,and pitch diameter. Some concerns in the automobile field are also apparently reluctant to take much stock in the Screw Commission's report, or at least to put it into practice.

Screw Thread Legislation Difficulties

Mr. James Hartness, a member of the Screw Commission, told us recently of an incident which illustrates very forcibly the difficulty in getting intelligent legislative action along the lines of standardizing thread measurements. They were trying to show a certain senator the desirability of action along the lines suggested and, just to show how good a grasp he had of the subject, they had to take a screw out of the telephone on his desk to show him what a machine screw looked like.

How many people, buying commercial taps in the open market, realize or appreciate the importance of the amount of lead error the tap makers are obliged to put up with? Take three commercial taps of almost any size or make, clean the threads well and hold them up to the light, one thread fitting into the other, and see if any of them do not show lead error. If they do not you are in luck. The ground tap and die chaser is the biggest step forward in years in that line. One of the oldest and largest tool making concerns in the country, has a tap making department and considers a tolerance of plus or minus 0.003 in. of lead error to the inch, as close as they can make a tap and sell it. If the die which cuts the screw has a similar error, due, of course, to the hardening, it is easy to see why we have to use lock washers to prevent the nut shaking off.

Now I am coming to something which as far as I know has not been considered very much. When we measure a screw by the three-wire or a similar system, we do so principally because we distrust the diameter at the top and bottom of the thread or, in other words, we want to measure the pitch diameter. That being the case, why should we expect the conventional form of female thread gage—which is nothing under the sun but a glorified nut—with 100 per cent thread to go on a screw cut by a commercial die, without the screw being a loose fit in a nut having, say, a 65 per cent thread but being correct in the pitch diameter. In other words, the tops of the threads of the 100 per cent gage fit tight against the bottom of the thread on the screw, and you are not measuring the screw at the same points where the nut or tapped part is going to fit.

I am advocating, and having done at the present time, the removal by lapping of 15 per cent of the tops of the thread on several female thread gages. That is

as far as I have the courage to go at present, even though we are definitely committed to the policy of not over 65 per cent thread in the tapped part. As long as the female gage corresponds to the tapped part, what harm would it do if 35 per cent of the thread depth were ground away, leaving 65 per cent, the same amount as the tapped part? Would I not get a more accurate measurement that way? I think I'm right, but I wish somebody who knows more about the big subject of threads than I do would tell me so.

Advertising—A Powerful Lubricant

By H. S. Strouse
Pawling & Harnischfeger Co., Milwaukee

THE chewing-gum or canned soup manufacturer can create a market for his product but, generally speaking, the traveling crane or hydraulic turbine manufacturer cannot. If he could create a market, the cost would be so excessive that there would be no profit. However, the machinery manufacturer by advertising can keep the merits of his product before the user at all times, and when the opportunity for a sale does come, his product will be well and favorably known and he will probably get a chance at the business which is let.

A market can be created for a new product that will cut production costs. If a new machine is brought out that will reduce by one-half the time, let us say, for machining an automobile flywheel, beyond a doubt advertising can create a direct market for this machine which will result in sales.

When the salesman for a well-advertised product sends in his card to a prospect, he is usually welcomed as the representative of a favorably known company. Once admitted into the office of his prospect, the salesman does not need to waste his valuable time selling his company. He can spend the time selling the product. In this way advertising can probably reduce the time of the average machinery salesman's missionary calls by at least 50 per cent, which means that twice the number of calls can be made. In effect, then, the advertising is doubling the size of the sales force at a very small cost which even the most skeptical will admit is distinctly worth while.

Direct and Indirect Results

I believe many machinery manufacturers judge advertising entirely too much by the direct inquiries they receive. Of course, when a new bulletin is advertised, the advertiser has a right to expect a number of inquiries, but if he is simply advertising his product, he cannot hope to pull inquiries from people who are not interested at the time. He should remember, however, that if he can get across his message at regular intervals, returns will come eventually, although a period of years may elapse.

Sometimes sales are made as a result of inquiries from advertising for which advertising never receives any credit. I refer now to inquiries that go directly to branch offices.

We had a case where a man sent his inquiry in to a branch office as a result of an advertisement. A sale for about $15,000 worth of machinery was made, but the branch office never indicated the source of this inquiry to us until several years afterward, when it accidentally turned up.

For thirty years my company has been building electric traveling cranes and hoists. About ten years ago we began building gasoline-driven excavating machinery mounted on corduroy (caterpillar type) traction. We conceived the idea of using this as a locomotive crane in and around industrial plants.

Our previous advertising of this product had been to contractors and many of our industrial customers did not even know we built this type of equipment. We therefore laid out a campaign among industrial plants describing our corduroy crane. Our campaign was carried on in metal and industrial papers and was supplemented with direct mail and a special eight-page bulletin.

In every advertisement we laid special emphasis on our thirty years' experience as crane builders, which we felt should give us a certain amount of prestige and which would aid in gaining immediate acceptance for a corduroy traction crane.

Well Planned Campaign

Our campaign cost about $2,000 and over $100,000 worth of machines were sold to industrial customers in less than a year's time and a large number have been sold since. Of course, every deal was actually closed by a salesman, but there is no question that the advertising was in a large measure responsible.

As was stated at a recent machinery convention, a well-made engine could probably run without oil, but it will certainly do a lot more effective work if lubricating oil is applied. In the same way a good sales force could sell some machinery with no advertising assistance, but advertising is a powerful lubricant which allows the sales effort to be applied in useful work instead of being wasted in overcoming useless resistance.

Excerpt from *Printers' Ink*, April 3, 1924.

The Cost of Strikes

Since its declaration on July 1, 1922, the shopmen's strike, involving approximately 300,000 employees on virtually every railroad in the United States, has cost the railroads about $125,000,000, according to estimates prepared by railroad executives. Further, a recent investigation shows that while the places of most of the shopmen who left their work about two years ago have been filled, many of the unions have still to call off their strike activities.

Some of the railroad officials point to the figures recently made public by the Attorney General's office, indicating that an investigation of conditions on fifty railroads shows an expenditure of $96,501,376 as the result of the strike.

Such figures, they point out, verify the estimates of railroad executives. They do not represent, of course, the full cost of the strike, because a large share of the expense was borne by the strikers themselves, and by the general public, which suffered through delays in passenger traffic and the handling of freight.

It is a great mistake to use air hose of too small diameter with pneumatic tools of any kind. In the Santa Fe railroad shops it has been found that ½-in. hose is too small to secure best results and ¾-in. or 1-in. is used for all air tools and motors.

Combined Record System for Costs and Inventory

By Wm. L. Myles

All records of labor and material kept in a visible index—Description of forms—How costs are determined—Purchasing index and payroll statistics

A FEW years ago, in the manufacturing plant with which the writer was connected, we operated a so-called cost system. Although this system was costly and almost valueless, many of our manufacturing plants of today are using similarly inefficient methods, and this case was in no sense exceptional.

The records were kept on cards filed in the drawers of a wooden desk. Each card carried a part number or job number and all labor charges were transferred from the mechanics' time cards to these cost cards, the greater part of the time required to operate the system being spent in hunting up the proper card and returning it to its proper place. We had a fair knowledge of our labor costs but the material costs left much to be desired. We knew the weight and cost per pound and a simple act of multiplication gave us the desired amount to charge for material used, "approximately."

It can be readily seen that this material cost was very inaccurate, since it did not take into consideration the spoiled or rejected material or the variation in weights of materials. If some hundreds of hours were spent on the finished article and we wished to determine a detailed cost, it could only be obtained some weeks or months later. This was too late to correct any shortcomings in manufacturing methods, as far as that particular lot was concerned.

System Developed to Meet Needs

We realized the need of an efficient inventory system and, believing that a systematized plant efficiently operated is far superior to one in which there is no system, some new methods of record keeping were developed and put into operation with excellent results. This is not a cut-and-dried, so-called efficiency system, purchased outside with a guarantee to cure all shop evils, but is the result of a careful study and analysis of our own conditions and requirements. Since its installation it has received three years of careful observation and development and its operation has been highly successful in saving time and money and providing accurate, timely data.

The record-keeping apparatus consists of several varieties of forms filed in the Rand Traco visible files, and performs the combined functions of the usual cost, stock, purchasing index and payroll statistics systems. Seventeen 12-drawer steel cabinets, each drawer containing 72 card holders, provide a card capacity for nearly 15,000 cards. The files require about 70 sq.ft. of floor space, and the time required per entry with the visible files is about one-fifth of that required by the old arrangement. We use a 5x8-in. double-folded card which gives a writing space in each holder equal to that of three single cards.

The records from which the cost of an individual part is determined are kept on the "Parts Inventory" card, shown in Fig. 1. It will be noted that this card has a column for material charges and a column for labor charges, as well as for total value and stock balance. When material is purchased, it is entered directly on this card from the invoice, under the heading "Material Received," the kind of material and the source from which it is obtained appearing in the upper left-hand corner.

Record of Detail Labor Charges

The next card-holder in the file, above the one containing the "Parts Inventory" card, contains the form shown in Fig. 2. All detail labor charges are first entered on this form, as shown, and then transferred to the "Parts Inventory" card, as will be noted in Fig. 1. We have, therefore, a complete record of the charges on this part at all times, filed on these adjacent cards; the one showing the total charges for labor and material and the other the detailed labor charges.

The labor charges are taken directly from the mechanic's time card. This card shows on one side the time clock record of the man and on the other side the record of his operation for the day. The total time spent is indicated, together with the parts worked on and the operation. The total amount of wage is figured and entered on the time card by the payroll clerk and the card is then passed along to the clerk who enters the charge on the "Parts Inventory" and "Labor Operations" card.

The foregoing indicates the method for collecting labor charges and charges for material purchased specifically for some part, but it may be necessary to use other stock material such as studs, bolts, nuts, etc. This material is withdrawn from the stockroom on a foreman's requisition, and these requisitions are priced from the "Stores Inventory" card, to be described later. They are then passed to the cost clerk, where the charges for this material are entered on the "Parts Inventory" cards. In this way all material and labor charges for any part are collected and totaled in a short time.

Upon the completion of a job the foreman reports the exact number of pieces finished and it is then an easy matter to obtain the true cost per piece. As the different lots of a given part go through the machine

PARTS INVENTORY

MATERIAL Cast Iron — WEIGHT EACH 16 lb — PRICE 10¢ — INVENTORY COST 10-@ 24⁰⁷/₁₀₀ — LOCATION AISLE 10 BIN 6 — WITHDRAWAL VALUE 2489

MATERIAL RECEIVED 1913 DATE	NO.	PART OR MDSE. NO.	VALUE	USED DATE	ORDER	NO.	BAL. IN STOCK NO.	LABOR DATE	AMT.	TOTAL VALUE AMOUNT
4/11	10	EE6 Pistons	1600				10			1600
								5/13	1350	1735
								14	1350	1870
								16	750	1945
								21	1050	2050
								30	900	2140
								5/1	700	2210
								5/12	200	2230
								5/10	1125	2342
								5/11	625	2405
								5/12	188	2423
										2489
				5/18	54600	3	7			1742

RESERVED STOCK - CARRY FORWARD: ORDER 56900 NO. 10

NO. 15 FIRM C B Smith INDEX CARD NO. INV.

EE6 Pistons — 6/10/13 ON ORDER

Fig. 1—"Parts Inventory" card, on which are collected all labor and material charges for making the part, the unit value being computed

LABOR OPERATIONS

TURN DATE	BAR'S NO.	PCS.	HRS.	COST	DRILL DATE	BAR'S NO.	PCS	HRS.	COST	MILL DATE	BAR'S NO	PCS.	HRS.	COST
4/18	83	10	9	1350	4/30	90	10	9	900	5/10	240	10	9	1125
19	83		9	1350	5/1	"		7	700	5/10	"		5	625
20	83		5	750	5/12	"		2	200	5/11	"		1½	188
21	83		7	1050										

Fig. 2—"Labor Operations" card. All detail labor charges are entered here, the daily total being transferred to the "Parts Inventory" card

STORES INVENTORY

MATERIAL Brass — WEIGHT EACH ____ LBS — PRICE .05 EACH — MAX 1200 — WEIGHT PER FOOT ____ LBS — PRICE ____ FOOT — MIN 100 — LOCATION AISLE 16 BIN 310 — WITHDRAWAL VALUE .05

RECEIVED DATE	QUANTITY	MDSE. ORDER	PURCHASED FROM	COST	USED DATE	ORDER	QUANTITY	BALANCE IN STOCK	VALUE
3/14	1000	76410	Keller & Co	5000				1000	5000
					7/12	55600	50	950	4750
					7/13	56720	50	900	4500
					7/13	59340	100	800	4000

RESERVED STOCK - CARRY FORWARD: ORDER ____ NO. ____ ORDER ____ NO. ____

NO. FIRM INDEX CARD NO. 2 INV.

3/4" Rough Brass Elbow — ON ORDER

Fig. 3—"Stores Inventory" card that records receipts and disbursements from the stock of purchased parts, together with the balance on hand

Fig. 4—"Shop Order Cost" card. Used to record labor and material charges when a customer orders a repair job or purchases parts

MATERIAL				LABOR					
DATE	NO.	MATERIAL USED	VALUE	DATE	MECH. NO.	OPERATION	HRS.	AMT	TOTAL VALUE

shop, the cost of the unit article is figured and recorded in the space marked "Inventory Cost." These costs will, of course, vary from time to time and the withdrawal value is obtained by averaging the inventory costs. In this way each deduction made is charged at an average cost, rather than a particular cost which may be either too high or too low. The "Withdrawal Value" space is located in the right-hand upper corner of the card, and this figure is the only one in which the clerk making a deduction is interested.

The "Parts Inventory" card also shows the location of the finished parts in the stockroom, a feature that saves considerable time when checking up the inventory of a part. Another feature is the column for reserved stock or allotments. When a certain number of machines are to be built, all the parts required are allotted to the order, and the card shows what portion of a stock of parts is available and what portion is reserved for a production order.

The "Stores Inventory" card, Fig. 3, is used to record all finished material purchased outside, such as magnetos, tanks, tools, screws, pipe fittings, etc. The make-up of the card is somewhat similar to the "Parts Inventory" card, and the maximum and minimum stock requirement notation gives us a complete control of our stock at all times. When the stock reaches the minimum, an order is sent to the purchasing department with complete information as to where the material was last purchased, the quantity purchased, the price paid, and the time of delivery. The purchasing agent is thus supplied with sufficient data to enable him to make an intelligent purchase, and the availability of the information in the visible index makes it unnecessary for him to keep a duplicate file of purchase data.

When the purchase order for material is placed, a copy of the order is passed to the inventory clerk and a note is made on the "Stores Inventory" card stating the date, quantity ordered and where purchased. A red tab is placed in the card holder under the celluloid edge in the space marked "On Order," and this saves the necessity of looking through order book or other files for the desired information.

Shop Order Cost Card

The "Shop Order Cost Card," Fig. 4, is used to record labor and material charges when a customer makes a purchase of parts or a repair job is done. Upon completion of the job, this card is attached to the shop order and passed to the billing department, where the invoice is made out. This insures a proper billing for all charges against the order, and a comparison of the cost card with the shipping list makes it possible to detect any errors before the invoice is made out. It is also possible for the manager to determine costs and profits easily and accurately as he has the complete story before him.

Records for the payroll department are also kept in these files and for these records both sides of the card holders are utilized. The front pocket contains an employee's record card, Fig. 5, the information recorded thereon being evident from the illustration. The income card, Fig. 6, for the same employee is filed in the back of the card holder and is a record of his weekly earnings. This information is very convenient when income reports are due, and we are able to make an accurate report with a minimum expenditure of time.

Due to the simplicity of this system it was not necessary to hire any additional clerks to operate it. It gives complete information as to costs, progress and condition of individual parts at any desired period of the operations, and is at the same time a perpetual inventory, showing the quantities in stock and values of all items, whether rough castings, partly finished parts, or completed product. These values are immediately determined and not weeks or months later as formerly.

Monthly statements can be presented to the manager or directors within two or three days after the close of the business month. These statements show the detailed values of the different kinds of materials, as well as other data regarding progress of work and costs which are of great interest to the management. The success of the system has been in a great measure due to the selection of the proper filing equipment and much credit is due the Rand Co. for its co-operation. The ease of operation, the visible index and the reliability of the records are all features that have made this system of great value and a source of continued pleasure.

Making a New Inch—Discussion

By R. E. Marks

The proposal of Senator King to establish a decimal system with the foot as the unit, as outlined in the editorial on p. 414, Vol. 60, of the *American Machinist*, is enough to make any mechanic weep. In the *American Machinist* of about 1888 or 1890 there was a somewhat similar proposal by John H. Cooper, Superintendent of the Southwark Iron Works in Philadelphia. Mr. Cooper proposed a new inch, equivalent to 1⅓ in. of our measure. His contention, as I remember it, was that a thousandth of a standard inch was too small for the average workman. This we now know to be fallacious.

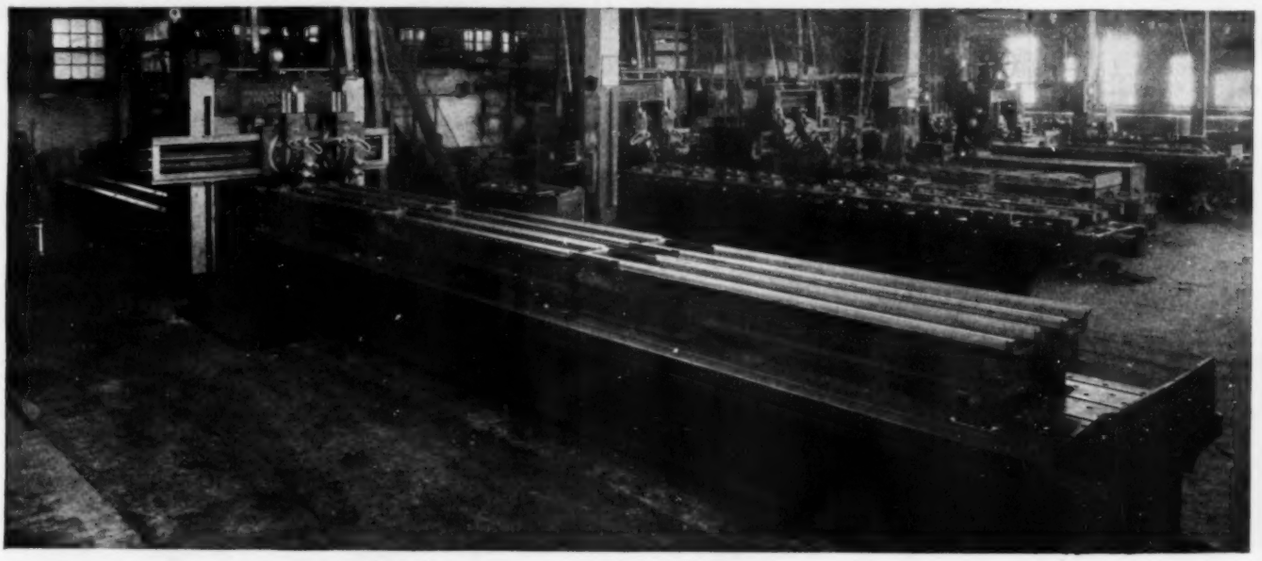
By a strange coincidence, one of the present editors of the *American Machinist*, Fred H. Colvin, criticized Mr. Cooper's plan, which was I think, originally contributed as a paper to the Franklin Institute. It is my recollection that Mr. Colvin pointed out the fallacy of establishing a new unit, although advocating the use of a decimal system based on the standard inch. It might be of interest to reprint an outline of this controversy that has such a close bearing on the present proposition.

The great objection to the metric system is the change in our unit of measurements. Senator King's plan is even more objectionable because, after changing the unit, ours would then be different from that of every other country, while at present we have practically the same system as all other English speaking countries. If we are going to depart from our standard inch, let us by all means go to the metric system.

No Change Is Desired

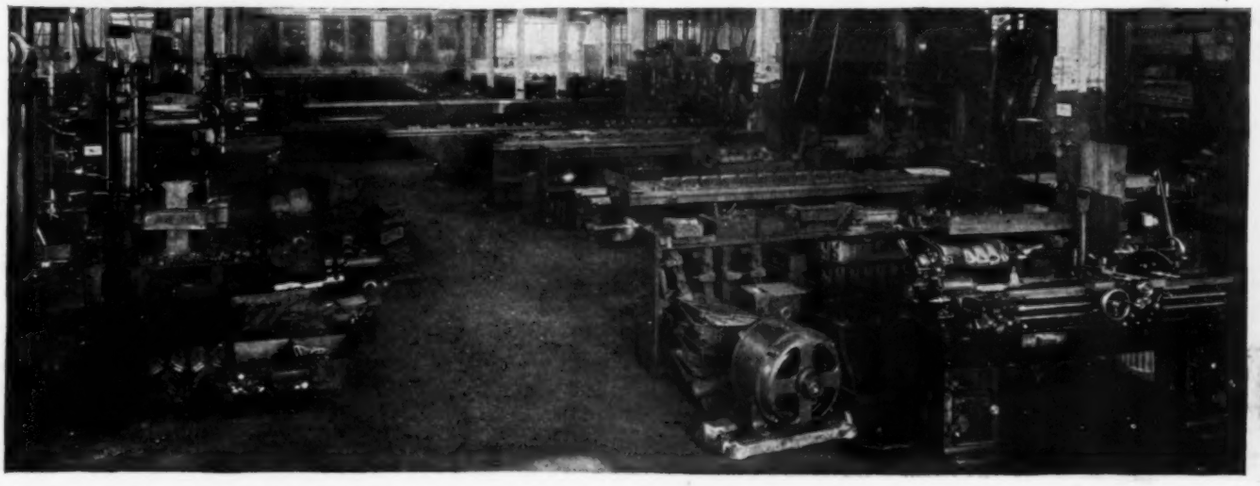
If those who propose changes for us would consult the industries that would be most affected, i.e., the machine building industries, they would soon find that no change of this kind is desired.

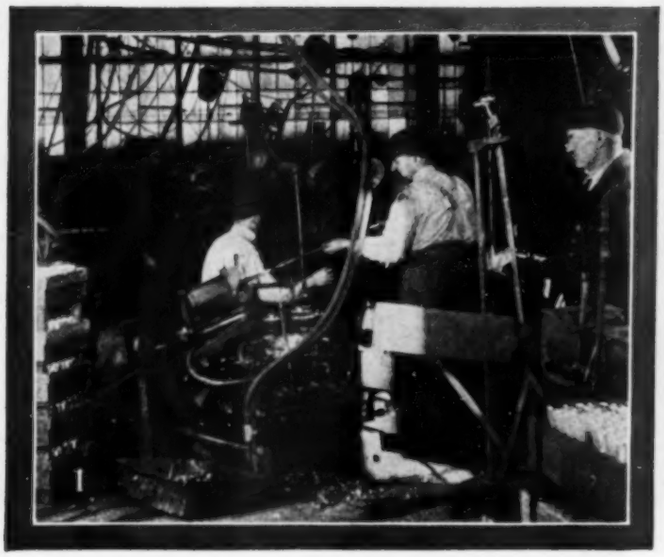
Most of us would welcome a decimal system with the inch as the basic unit. A 10-in. foot and a 10-ft. yard, with a 1,000- or 10,000-ft. mile would be agreeable to all but the civil engineers, and would most greatly inconvenience them. Then we could do away with our illogical 5,280-ft. mile, our acre with 208 ft. on a side and many other ungainly measurements.

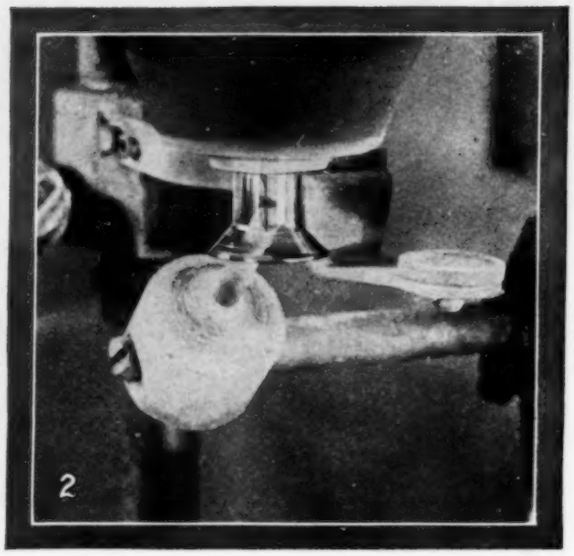


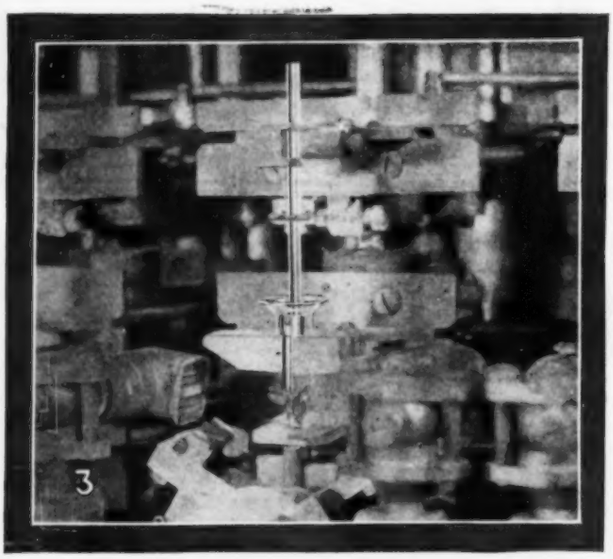
Where Machine Tools Are Made

The Willard Machine Tool Company
Cincinnati, Ohio
Founded 1900









Getting Ready to A

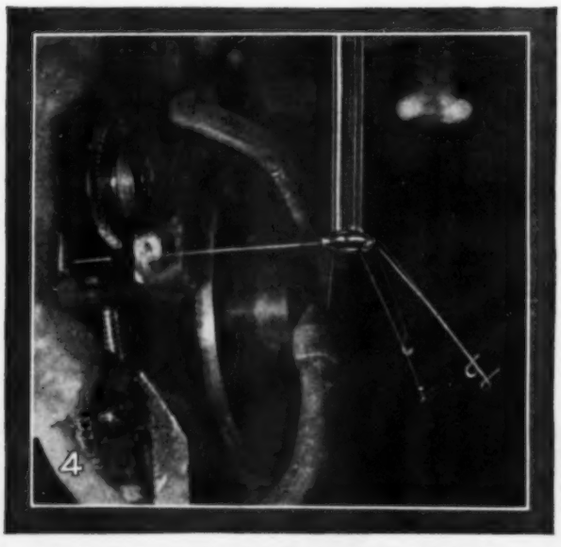
Fig. 1—Blowing bulbs for electric lamps

Fig. 2—Forming flares for Mazda lamps

Fig. 3—Making and sealing the stem

Fig. 4—Inserting support wires automatically

Fig. 5—Filling the bases with cement



to Abolish Darkness

Fig. 6—Inserting parts in the sealing-in machine

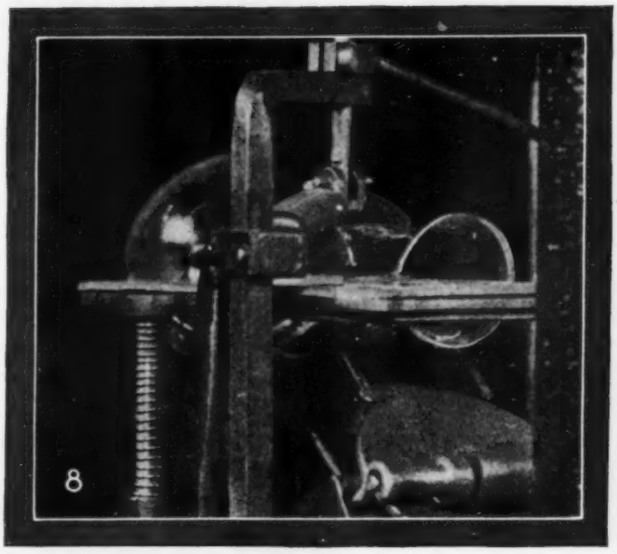
Fig. 7—Machine for sealing the mount in the bulbs

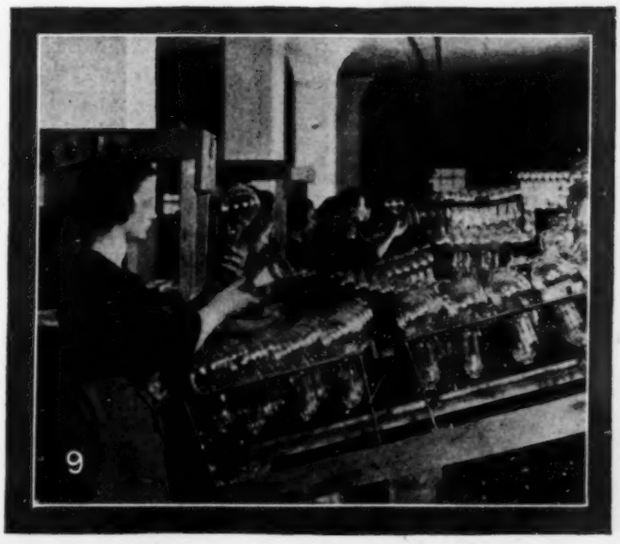
Fig. 8—Etching the trademark with acid ink

Fig. 9—Washing, drying and inspecting

Fig. 10—Final inspection and packing

Photographs by courtesy of Westinghouse Lamp Company





Receiving finished grease plugs from a New Britain automatic

Taking finished piston-valve packing rings from a Potter & Johnston

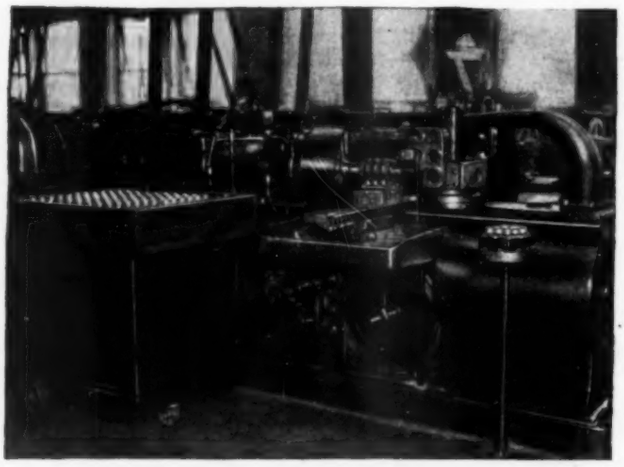
Portable Serving Cabinets in a Railroad Shop

As used in the Mt. Clare Shops of the B & O

Photographs by courtesy of the Baltimore & Ohio Magazine

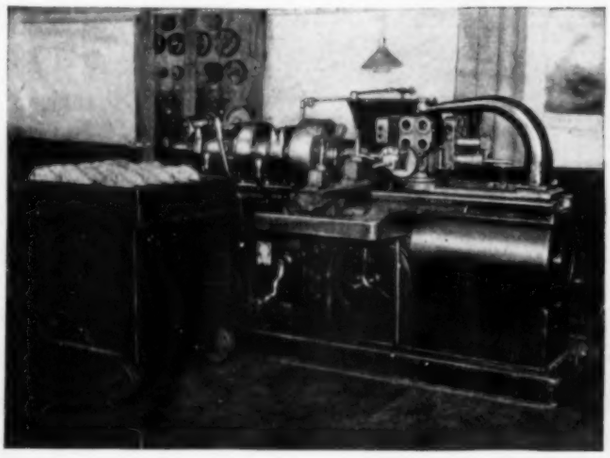
Finishing oil-cavity spuds on a Potter & Johnston. Note loaded fixture on stand at right, serving table at left

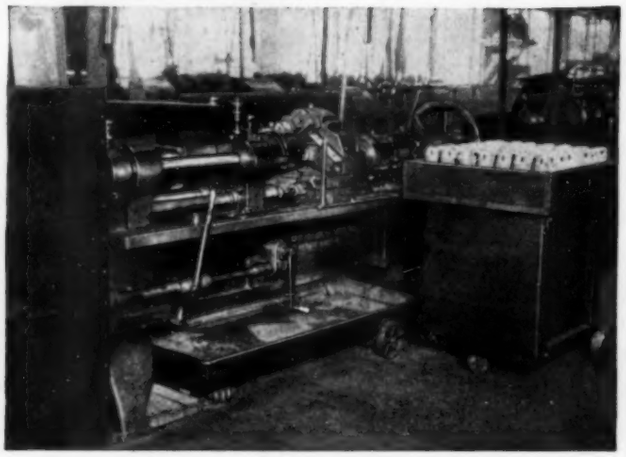
Below — Serving table takes crankpin washers from a Potter & Johnston



In each case illustrated, the serving table is rolled from the machine to the inspection department

Below — Cylinder - cock bodies taken from a New Britain automatic





Difficulties in Making Tapered Shells

By Jack Williams

Drawing shells with parallel sides—The cause of buckling and wrinkling—Flowage of the molecules—Metal unsupported in stamping operation—Variation in density of metal

EVERYONE who has had experience in the production of tapered or conical shells of sheet metal, is fully aware of the difficulties to be encountered in preserving the walls in a smooth and unwrinkled condition during the instant of transformation from parallel to tapering sides. In a drawing operation that produces a shell of uniform diameter from end-to-end, the metal is at all times confined between two unyielding barriers of hardened and polished steel, separated from each other only by the thickness of the metal of which the shell is composed, so that there is no opportunity for the material to buckle and fold over upon itself in the form of wrinkles. In the production of tapered shells, however, the tools cannot finally close together upon the metal until the moment the shell is completed, and, during the transformation stage it remains unsupported.

THE production of tapered shells of metal is attended with a great deal of difficulty because of the tendency of the material to wrinkle during the final operations of transformation from parallel to converging sides. At this moment the metal is—so-to-speak—"in the air," being unsupported by the walls of the tools; and as it is compressed upon itself in the act of passing from a larger to a smaller circumference, it is extremely likely to fold over and cause wrinkles and seams that no amount of pounding in subsequent stamping operations can eliminate. If seams are not actually formed, the metal will be more dense along the line taken by the wrinkle and will cause streaks and bands of varying color that can never be polished out.

That the cause of buckling and wrinkling may be understood by designers and toolmakers who may not have had the advantage of experience with drawing and stamping tools, let us consider what happens during the fraction of a second after the blank-holder of a drawing press has come to rest upon the surface of a blank, and the punch is passing into the drawing die.

To begin with, we may have a round flat blank of sheet metal having a diameter and uniform thickness of—let us say—9 in. and $\frac{1}{16}$ in. respectively. This blank may have been cut out in a previous operation and we may place it by hand in proper position over the drawing die, where it is located by the gage, or "set-edge"; or it may have been blanked out from a sheet of metal by the descent of the blank-holder, which in this case would also be the blanking punch, and its shallow mating die the set-edge of the drawing die. This latter mode of procedure—called "blanking and cupping"—is the usual one, as it eliminates altogether the time consumed by separate blanking.

In either case, the smooth, flat, underface of the blank-holder comes to rest upon the surface of the blank, and remains there, exerting a uniform but not heavy pressure upon it, while the drawing punch, actuated by the crank and gate of the press, passes down through the center of the blank-holder and enters the drawing die, pushing the metal of the blank before it.

Now let us suppose that our drawing die is 5 in. in diameter and that the diameter of the punch is $4\frac{7}{8}$ in.—twice the thickness of the drawing metal less than the diameter of the die. Let us suppose, also, that the stroke of the press has been so adjusted as to complete its downward movement and commence to withdraw while the edge of the blank is still $\frac{1}{2}$ in. from the drawing die. We will now have a 5-in. diameter cup, or shell, with a $\frac{1}{2}$-in. flange surrounding the open end.

A little figuring will show us that the perimeter of our original 9-in. blank was a trifle more than $28\frac{1}{4}$ in., while the same calculation applied to the flange will show but a scant $18\frac{7}{8}$ in. What has become of the $9\frac{3}{8}$ in. of metal that is no longer there? It cannot have passed into the shell, for it has not yet reached the drawing die.

If we apply our micrometer to the flange we will discover (to our astonishment, if we have not before considered it) that the erstwhile $\frac{1}{16}$-in. sheet of metal has now become almost, if not quite, $\frac{3}{32}$ in. thick. The blank will "draw" (spread out) to some extent under the blank-holder, but if we have not taken this thickening of the metal into consideration in making the tools, and there is no "give" to the blank-holder slide, the limit of tensile strength of the material will have been passed and the partially formed cup torn out of the blank by the punch.

This thickening of the metal is the result of the crowding together of the molecules of which it is composed as the perimeter of the blank lessens—a sort of cold upsetting process; and it is the office of the blank-holder to confine the metal and prevent it from wrinkling as the thickening progresses.

By courtesy of Bridgeport Brass Co.

As the metal passes over the rounded edge of the drawing die, it must enter the annular space between the die and the punch, and this space in a properly constructed set of tools will be equal to the original thickness of the blank. It may be seen, then, that in the operation of drawing, the metal is constantly thickening as it approaches the edge of the drawing die, and as constantly thinning out as it passes that edge and is "ironed out" by the unyielding walls of the tools.

Brass and copper will, because of their superior malleability, withstand the upsetting process to a greater degree without buckling, than will steel. On the other hand, because of their inferior tensile strength, they will not stand the ironing out as well. Therefore the softer metals have little, if any, advantage over steel so far as the drawing of shells with parallel sides is concerned; though they are less severe on the tools.

Successive Reductions Must be Slight

In succeeding operations upon shells with parallel sides—properly called redrawing operations—there can be no blank-holder and no means of confining the metal until it has entered the annular space between the punch and die. Nevertheless, the thickening of the metal proceeds as before in proportion to the reduction in perimeter, or circumference, of the shell, and the successive reductions must, therefore, be comparatively slight. If we consider the partially redrawn shells shown in Fig. 1, we can understand that, while the wall of each of the parallel parts is of uniform thickness—having been made so by ironing out in the tools—the metal of which the rounded shoulders are composed, must thicken up in each case as it approaches the junction with the smaller diameter.

We have, therefore, in any redrawing operation, a condition in which the thin-walled shell (original thickness) is adjoined by a flange of thicker metal that diminishes in its thickness as it approaches the diameter of the previous draw. This "wave" of thicker material, stationary with respect to the die, flows over

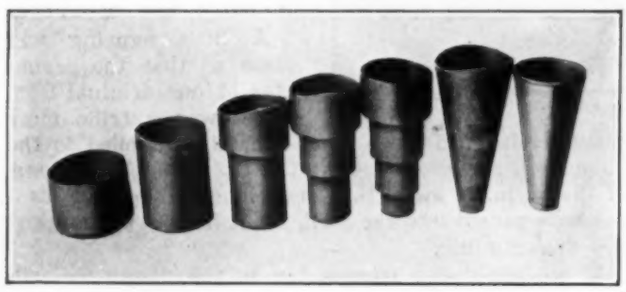


Fig. 1—Stages in the production of a tapered shell

the length of the shell as the redrawing proceeds. It is only in this comparatively short space that crowding or upsetting of metal, takes place.

In making a tapered shell, the annular space between the cone-shaped die and punch can equal the required thickness of the shell wall only in one relative position, and that position is reached only at the instant of completion. Any change in thickness of the material as the diameter of the shell decreases toward the smaller end, must necessarily take place with the metal unconfined. Nor can there be any ironing out of the metal as in the drawing operation. Wherever the thicker metal may be disposed, it can be reduced in thickness only by the applications of external pressure.

The final operation in the production of a tapered shell is, therefore, performed by stamping. To minimize the flowage of metal during the transformation, the shells are prepared for this operation by what is called "stepping," or "step-drawing" them until the contour approaches that of the desired cone. The relation and diameter of the steps must be calculated so that prac-

Fig. 2—The stamping operation

tically no stretching of the metal can take place; for that is very likely to result in a split shell. The more steps there are in the prepared shell, the more nearly uniform will be the structure of the finished product.

Brass and copper are, because of their superior malleability, much better adapted to the making of tapered shells than is steel, and are usually chosen for the purpose. The illustration, Fig. 1, shows a composition shell—high in copper—that is produced in eight operations (not including the trimming and beading, apparent in the finished shell) and some of the stages through which it has passed.

Details of Drawing Operations

The blank from which this shell was made is 4½ in. in diameter and the metal is 0.035 in. thick. The first operation is the double one (counted as one) of blanking and cupping, in which the blank is cut from the sheet and passed through the drawing die in one stroke of the press, resulting in the shell shown at the left end of the row. It has been reduced to a diameter of 2¼ in. and is 1¾ in. deep. The wall is still 0.045 in. thick.

In the next operation—the first redraw—the reduction in diameter of the shell is comparatively slight and, though the metal thickens up as it flows to the die, it is immediately ironed out by the tools. In this operation the shell also passes clear through the drawing die, and is stripped from the punch beneath the press as the punch ascends.

The third shell from the left end of the row has passed through a partial redrawing operation, resulting in the first of the steps. The stroke of the press is adjusted to withdraw the punch when the proper length of redraw is reached, and the shell is pushed out of

the die by a knock-out and stripped from the punch above the die. The lower part of the shell now measures 1½ in. in diameter and is 2¼ in. long.

The fourth and fifth operations are but repetitions of the third. The shell, though still far from a cone, is approaching a conical shape and the metal is being distributed in such manner as to flow easily into the desired places in the final operations of stamping.

The next shell, the second from the right end of the row, has passed through two identical operations in the tools shown in Fig. 2. The stepped shell is placed in the die and struck a single blow with the tapered punch (this tool is usually called a "force" when applied to stamping operations) causing the lower end of each parallel step to close in and the shoulders to fold downward until the shell assumes the shape of the die. The swiftness with which the blow is delivered has much to do with the success of the result; if the pressure were applied slowly a wrinkled shell would inevitably be produced.

In any operation that involves flowage of the molecules, the metal becomes hardened to some degree, and it is, therefore, necessary to anneal it. Between each of the foregoing seven operations, all of the shells of the lot have been taken to the annealing furnace and there subjected to a dull red heat in order to restore the property of malleability.

Though the shell as it comes from the first stamping operation has the appearance of a smooth cone, the wall is not yet the uniform thickness, and it is again passed through the stamping tools after annealing to thin out the thicker parts. The operation of stamping approaches more nearly to that of swaging or forging than to drawing, and though it may in this case result in a wall that is practically uniform in thickness, no amount of stamping can ever remove the alternate bands of light and dense metal of which it is composed. These bands are plainly apparent in the picture.

This condition will persist, however many stampings the shells may be subjected to, and no amount of polishing will remove the appearance. The shell is therefore passed through the eighth operation, which is burnishing, in which it is placed upon a rapidly revolving conical arbor of hardened steel and a burnishing tool is passed over its length under heavy pressure. This operation densifies the metal over the entire outer surface of the shell, and puts it in condition to receive a polish that will not show the varying bands of color.

Chip Handling in a Railroad Shop

From the nature of the work done in it, a railroad shop is usually rather dirty. That steps can be taken to eliminate some of the dirt is shown in the two photographs reproduced here by courtesy of the *Baltimore and Ohio Magazine*. In the Mt. Clare shops of the B. & O., of which T. R. Stewart is superintendent, removal of chips is facilitated by the appliances illustrated.

In Fig. 1 a boring mill is shown fitted with chip guards that direct the borings and turnings into pans situated on either side of the machine base. The pans are emptied into a larger pan by the operator or by a laborer, the larger pan being handled on a shop truck.

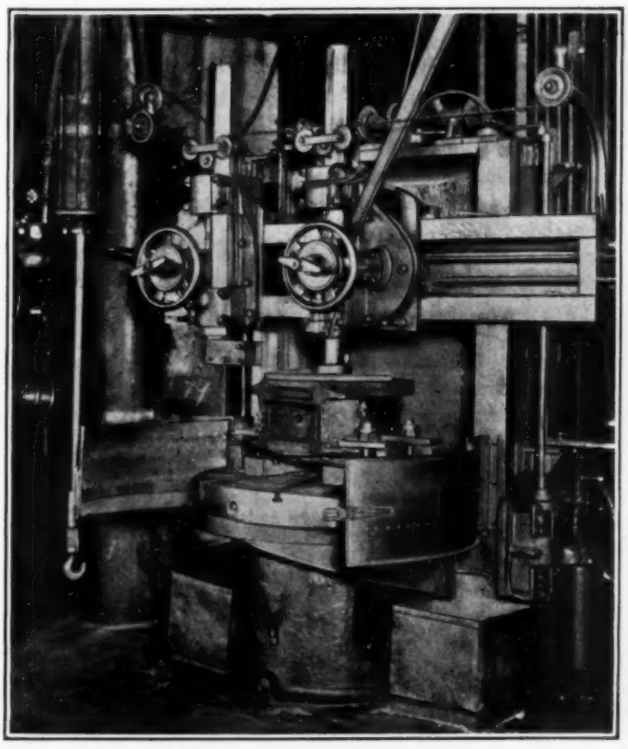


Fig. 1—Chip guard for boring mill

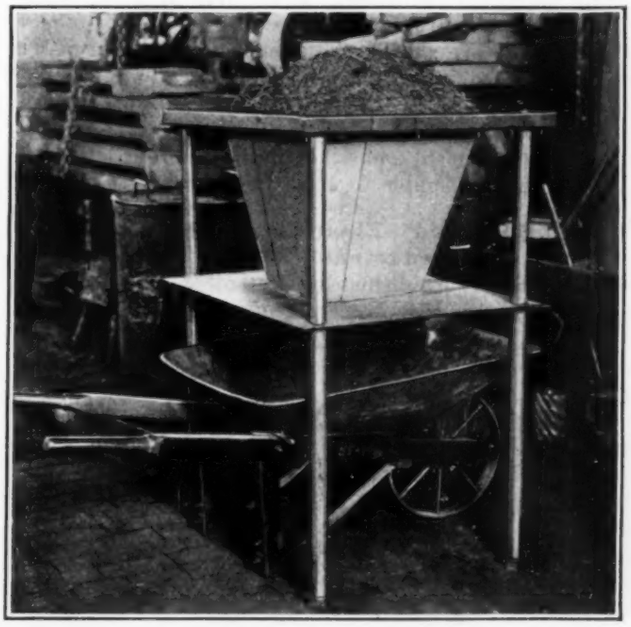


Fig. 2—Chip collecting hopper

Sweeping up chips from the floor is thus practically eliminated.

Another appliance for disposal of chips is illustrated in Fig. 2. The container stands near a machine or group of machines, and chips are emptied into it by the operators who are thus relieved of the necessity of standing on a chip-littered floor. A sliding bottom makes dumping of the contents of the container an easy matter. The hopper holds just a wheelbarrow load.

Book Reviews

The Art of Lettering. By Carl Lars Svenson. One hundred and thirty-six 8x10-in. pages. Ninety-six illustrations. Published by the D. Van Nostrand Co., 8 Warren St., New York City. Price, $3.50.

Mr. Svenson correctly states that his book presents much in the way of preliminary and detail information and suggestion for the study of lettering and for the acquirement of skill in the handling of the proper materials. It is more than a lettering book, as its co-relation with art will provide a text adapted to the use of art schools, artists, commercial illustrators and all who are interested in the use of lettering either alone or with other forms of design.

The text embraces the fixation of letter forms, influence of art, requisites of good lettering, lettering tools and materials, parts of a letter, strokes, variety of pens, etc., to the study of alphabets,—Roman, Nicholaus Jenson, Dürers construction, English Gothic, German Gothic, Modern Roman, Italic—and finally to the application of hand lettering in advertisement, poster design, monograms, ciphers, etc.

Everyone of the 96 plates that illustrate the book is a lesson in itself. The letters are taken apart and analyzed, and one is advised as to the best style of pen to use for the different types of letters.

Carefully selected examples are exhibited, which have an added interest through having been actually used for the purposes indicated. Miniatures of every style poster from "Cruises de Luxe to the Tropics" to memorial tablets are shown, the applied lettering in many cases combined with a suitable illustration. Monograms and ciphers by Emelia Svenson, and by George Auriol,—examples of the work of W. J. Norris, Prof. Rudolph von Larish, and other authorities on lettering make the book valuable to students.

"Mechanical World" Electrical Pocket Book, 1924. Green clothboard covers. 326 four by six in. pages, illustrated. Published by Emmott & Co., Limited, 65 King St., Manchester, England. Price 1/6 net.

This book is an annual publication containing a collection of electrical engineering notes, rules, tables and data.

Several new and important features have been introduced in the present edition. The sections on accumulators, electric lamps and lighting, electricity in ships and electric welding have been rewritten to bring them up to date. Revisions have been made in other sections, and some new material added. Beyond this there is nothing to be said about the book, not contained in our last year's review.

"Hutte" Taschenbuch fur Betriebsingenieure. 1,273 pp. 4¼x7¼. 1,431 illustrations. Published by Wilhelm Ernst & Sohn, Berlin.

The Hütte handbook for industrial engineers is something in the nature of a miniature encyclopedia. It is printed in German, of course. The material has been prepared by various members of the Association of Industrial Engineers and collected under the direction of Dr. Ing. A. Stauch.

Subjects treated in the handbook begin with raw materials used in the ordinary industrial plant and continue through methods of handling, inspection, standardization and testing to the various branches of management — organization, factory layout, safety work, selection of employees, training, workers' organizations, etc.

Casting, welding and soldering are next covered and then metal forming under hammers and presses, heat treating and hardening, and finally cutting tools, air tools, electric tools, machine tools and woodworking machines. The final chapter is on balancing.

Welding Experience from Two Railroads

Regarding the increasing use of oxy-acetylene and electric welding, the master mechanic of a large road, gives some of his experience below. The shop is not large, being at a comparatively small division point. He writes:

"We have no complete record of costs of these new methods but a few comparisons are of interest. In the case of cylinder saddle bolts, it formerly took a machinist and helper from 16 to 32 hr. to knock out a set of 50 bolts, depending on how badly they stuck. Using the oxy-acetylene torch a machinist and helper burn out the 50 bolts in 5 hr. on the average.

"All our locomotive frames and engine truck frames are welded with oxy-acetylene, using a pipe-line system. Driving-wheel spokes are welded with the electric arc. The only welding we do on flues, is to weld pitted flues and to weld the safe ends on superheater flues. We also weld in half and three-quarter flue sheets, door-hole ring and side-sheet seams, on boiler work. Such work is done with the arc welder.

"All worn parts, such as frames where spring hangers have been chafing, engine truck jaws, brake-hanger casting-pins, and link-motion pins, are built up with the electric arc.

"The expansion on cast iron is taken care of by preheating the piece before starting to weld. On engine frames, the expansion is taken care of by spreading the frame apart. Where it is tied together with more than one rail, the rail that is not cut or broken is preheated, to allow for expansion.

"We have some failures on acetylene welding. We try to prevent failure by investigating to ascertain whether it is the fault of the man, the method, or the material."

Reports from another road state that out of 125 locomotive frames welded with thermit about 95 per cent were successful. On truck frames, oxy-acetylene welding has given good results.

In flue welding, this road uses the blacksmith forge, but only about 50 per cent of the welds prove satisfactory. Flue sheets and side sheets, however, are, being very successfully welded with the oxy-acetylene torch. Worn pedestal jaws, wheel flanges and other places worn by chafing or otherwise, are built up by the oxy-acetylene process. Where necessary, care is taken to preheat work to allow for expansion due to welding, and the use of oxy-acetylene has been found very satisfactory on all work.

The Santa Fe railway shops have discontinued the use of white lead in making press fits. Red mineral paint, the same as used on box cars, is now used for press fits of locomotive and tender wheels, crankpins, crank axle disks, etc.

Keeping Subway Trains on Schedule

By Fred H. Colvin
Editor, *American Machinist*

The second article—Showing how motor pinions are removed and armatures taken out of the motors — Method of testing pinions for cracks

AFTER the motors have been removed from the trucks and brought to the motor repairing department by the four-ton Sheperd monorail hoists, one of the first operations is to remove the driving pinions from the ends of the armature shafts. A special hydraulic pinion-puller has been devised for this work and is shown in Fig. 9. The pinion-puller is operated by a Watson-Stillman hydraulic pump mounted on one end of a small truck, the other end having a pair of brackets at *A* which support the pinion-puller *B*, when not in use. The truck is taken to the motor and the puller *B* slips over the pinion, and hydraulic pressure is applied by the hand pump, as shown. The connection is a soft copper tube which is sufficiently flexible for this purpose.

Further details of the pinion-puller can be had by referring to Fig. 13, which shows the same truck with the pump at *A* and the pinion-puller at *B*. At *C* and *D* are shown other pulling heads which are used on different sizes of pinions. The outer end of the puller has an internal gear which slips on the motor pinion, the face of the internal gear being sufficiently narrow so that it can be pushed clear over the pinion and turned one-half a tooth. In this way each tooth of the puller is behind a tooth on the pinion. Any pressure needed is then applied to a small hydraulic plunger in the end of the puller by means of the hand pump, and the pinion is very easily pulled off the armature shaft.

In another application of the pinion-puller, which is not illustrated, a three-jawed puller is provided in place of the tooth puller for handling pinions, and is used for removing the oil protectors or shields which go over the end of the armature shaft. This puller is operated in the same way as the one already described for pulling pinions and is equally convenient, as the oil protectors are difficult to remove in any other way.

With the pinion removed, the next step is to take the armature out of the motor, this being done by a special machine, as shown in Figs. 10 and 11, Fig. 10 being a later development. The motor, mounted on a suitable carriage *A*, Fig. 10, which travels on the bed of the machine, is moved to the left until the long shaft *B*, with its coned end, enters the center in the end of the motor shaft. With the other end of the motor shaft supported by a similar center the carriage *A* is moved to the left, carrying the motor frame off the armature and leaving it suspended between two centers as in a lathe. The broad sling, attached to the hoist, is placed around the armature, as at *A*, Fig. 11. When the hoist is operated to take the load, the centers are backed off, leaving the armature suspended in the sling, by means of which it is carried by a four-ton telpher hoist and lowered to a truck having a capacity of four armatures.

The truck shown in Fig. 12 runs on a track flush with the floor and carries the armatures to lathes or winding machines into which they are placed by an air hoist. In this manner the armatures are handled without loss of time or labor.

Commutators are turned in lathes. In the winding

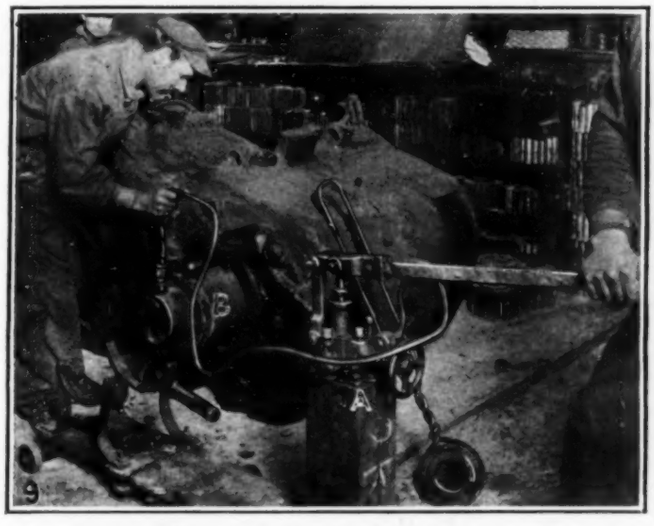


Fig. 9—Pulling the driving pinion from the motor shaft.

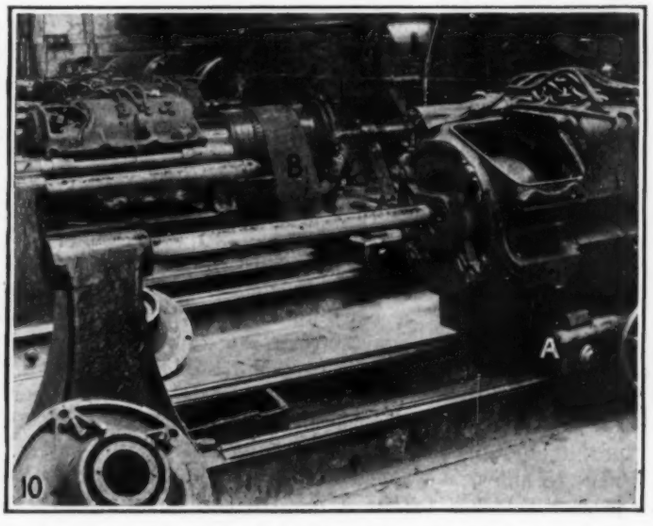
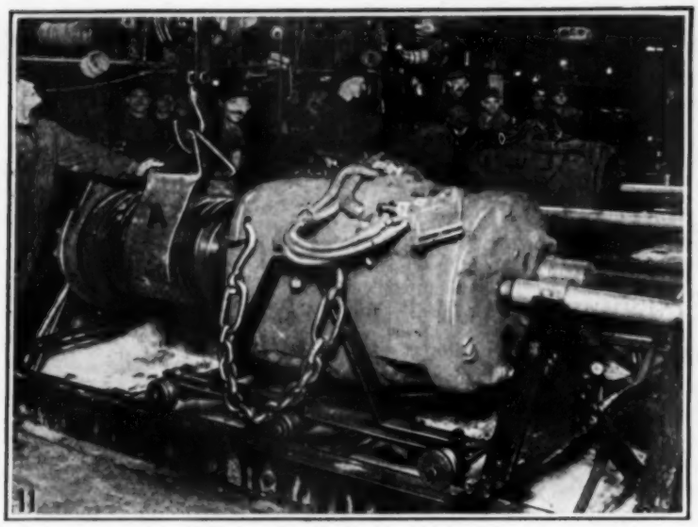


Fig. 10—Getting ready to remove armature from motor



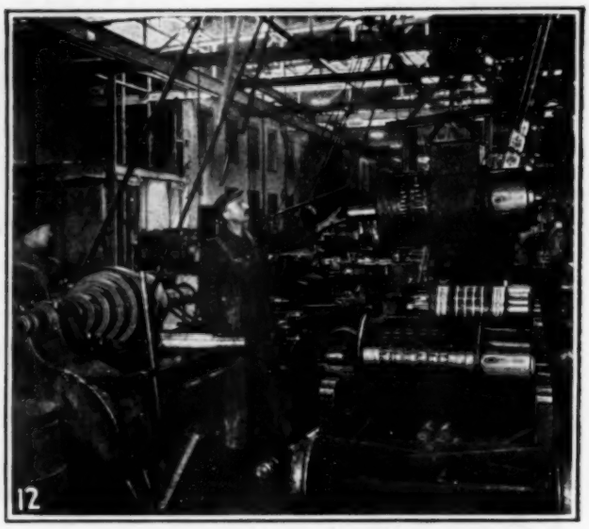
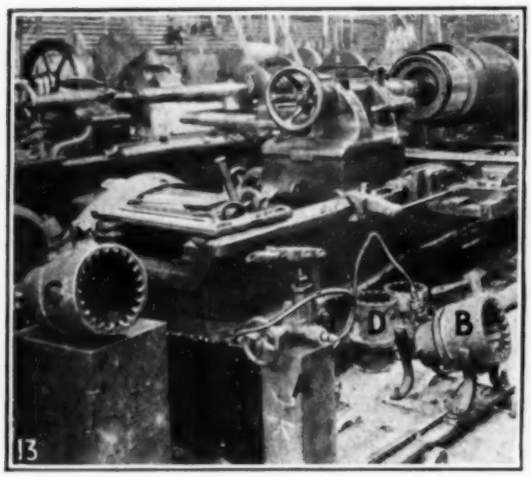


Fig. 11—Armature removed and in sling for hoisting. *Fig. 12—Truck and hoist for handling armatures*



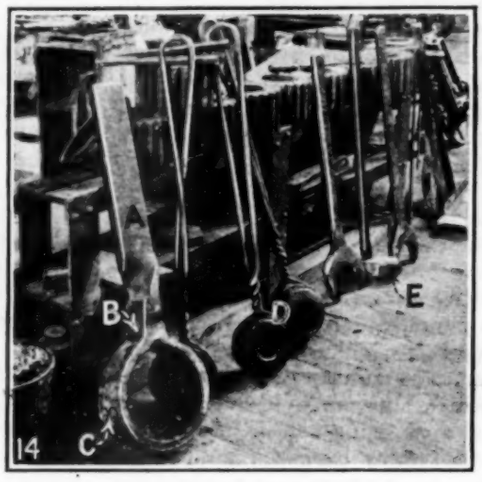


Fig. 13—Details of the pinion-puller. *Fig. 14—Some of the special tools used.* *Fig. 15—Using the pinion wrench*

machines burned out coils are replaced, binding wires renewed, connections soldered and any other necessary repairs made.

In addition to showing some of the details of the pinion-puller, Fig. 13 also shows an armature in place in a modern, motor-driven lathe, in which the commutator has just been turned. To the left is shown another lathe in which an armature shaft is being turned, all necessary machinery for armature work being concentrated at this one point.

Some of the special tools and devices for removing and replacing the pinion on the armature shaft are shown in Fig. 14, while Fig. 15 gives an idea of their application. The special wrench *A*, Fig. 14, is for turning the pinion on the armature shaft, or for holding it against turning as may be desired. It is a simple tool consisting of a bent up ring with a substantial handle twisted a quarter-turn, so that it may have maximum strength in the proper direction. The round end is riveted to the handle at *B* while at *C* two plugs are inserted which serve as a tooth, fitting into the pinion and preventing its turning inside the wrench. Fig. 15 shows a wrench in place to hold the pinion in proper relation to the armature shaft, in order that the keys and keyways may match. The pinion is driven into place by the use of the hollow plug shown at *D*, Fig. 14, the plug being provided with a long handle so as to be easily held against the pinion while the helper strikes with the sledge *E*.

The driving pinions are subjected to very severe

Fig. 16—Testing driving pinions for cracks

usage, and any defects which show up in service are apt to cause serious damage. In order to take every possible precaution, each pinion is carefully inspected every time it comes into the shop. After being thoroughly cleaned the pinion is placed in the tank *A*, Fig. 16, which is filled with boiling oil, and is allowed to remain there until it assumes the temperature of the contents of the tank. It is then removed and wiped off after which it is coated with a mixture of whiting and alcohol, of the consistency of thin paint. The heat dries this rapidly leaving a white coating. Each tooth is then struck several blows with a hand hammer with sufficient force to jar it thoroughly. If any crack exists the jarring causes the oil, which penetrated the crack while the pinion was immersed in the tank, to ooze out, forming a thin black line on the white surface which is readily seen by the naked eye, even though the crack itself may be invisible through a powerful magnifying glass. This is quite similar to the practice in many railway shops for detecting cracks in locomotive frames, connecting rods and other parts.

The Solution of Formulas

By Leslie R. Jones

Formula solution, to many, is a partial, if not a complete mystery. The prevailing impression seems to be that a person has to be a skilled mathematician in order to possess a working knowledge of how to manipulate a formula to obtain a desired solution; also that extensive algebraic experience is absolutely essential.

While this is undoubtedly true for the more complex type of formulas, it is generally not true for the solution of ordinary shop problems and the formulas involved, with which the average mechanic and artisan has to deal.

Therefore, with this in mind, I have prepared the following which I hope will be of timely assistance to the mathematical layman who, desiring an insight into this valuable science, has not the opportunity or the time to take up the study in a more complete or academic way.

Let us consider the fundamental laws and definitions:

A formula is essentially an equation. An equation is an equality between quantities. (The term quantity is used to denote anything taken as a unit).

Thus: $10 = 4 + 6$

$A = D^2 \times 0.7854$

10c. = one dime.

are all equations, the quantities on both sides of the equation or equal sign being of equal value. In other words, a formula may be considered a rule which has been rewritten by the use of various signs and symbols into a compact, plain and mathematical form. To illustrate:

The rule for finding the area of a circle is: Square the Diameter and multiply this result by *Pi* divided by four. Expressing this rule as a formula we have:

$$A = D^2 \times \pi \div 4$$

Where, A = Area required;

and, D = Diameter of circle;

Pi = 3.1416 (Constant).

A comparison of the rule and the formula in some cases will not show any significant gain in clearness for the formula, but in the more complex type this advantage is readily seen and its compactness is a great asset in mathematical work and calculation.

Let us next consider the conventional signs used in general formulas:

(+) (−) (÷,/,—) (=) (×,·,) ($\sqrt{}$) ((),[], $\{\}$,—)

1 2 3 4 5 6 7

No. 1 denotes addition and is called the plus sign. Thus: $6 + 4$, and $a + b$, indicate that 4 is to be added to 6 and b to a.

No. 2 denotes subtraction and is called the minus sign. Thus: $6 - 4$, and $a - b$, indicate that 4 is to be taken from 6 and b from a.

No. 3 denotes division. Thus: $6 \div 4$, $6/4$, $\frac{6}{4}$, all indicate that 6 is to be divided by 4.

No. 4 is the sign of equality or equal sign. It is used to denote equality between two quantities. Thus: $8 = 4 + 4$, indicates that 8 is equal in value to $4 + 4$, which we know to be true. Also, $a = b + c$ indicates that a is equal in value to $b + c$ which in this stated case must be true or the equation sign could not be used. By referring back to the definition of the formula it is plainly seen that the two cases given in No. 4 are simple equations or formulas.

No. 5 denotes multiplication. Thus: 6×4, $6 \cdot 4$, $a \times b$, $a \cdot b$, all indicate that 6 is to be multiplied by 4 and a by b, respectively. There is also another way to denote multiplication. When no sign is used multiplication is said to be noted by juxtaposition. Thus: (6) (4), $3\sqrt{2}$, ab, $abcd$, indicate multiplication as though they were written: $(6) \times (4)$, $3 \times \sqrt{2}$, $a \times b$, $a \times b \times c \times d$.

No. 6 is the radical sign and is used to indicate that a root is to be taken of a given quantity that follows the sign. Thus: $\sqrt{2}$, $\sqrt[3]{3}$, $\sqrt[5]{444}$, indicate that the square root, cube root, and fifth root are to be taken respectively.

Root Signs and Aggregation Symbols

The small number placed at the opening of the radical sign is called the index number and denotes the root to be taken. When no number is written in this position, the second or square root is understood to be that indicated. In algebraic work letters are used instead of numbers, but in general formula solution such as is encountered in shop practice, numbers are usually used. We will deal only with positive whole numbers as exponents and roots. No. 7 includes symbols of aggregation. They are parentheses, brackets, braces, and the vinculum, respectively. They all indicate the same thing, namely, that all the quantities enclosed within are to be taken as a unit and subjected to the same operation. In general work any of the given signs of aggregation is usually referred to as parentheses. The operations indicated inside are to be performed before those outside. Consider the following: $\frac{3+5}{6+4}$. Used in this way the vinculum performs three duties. It not only indicates division but it also binds together into one unit both the numerator and denominator of the fraction. When only one symbol of aggregation is needed the parentheses are used; if two are needed, parentheses and brackets. For three, the parentheses, brackets, and braces. For four, the parentheses, brackets, braces, and vinculum. In using all four use the vinculum first or innermost, the parentheses second, the brackets third, and the braces fourth or outermost. Thus: $2\{14[8 + \overline{(4 + 3} - 2)] - 2\} =$

360. To solve, begin with the innermost symbol of aggregation and work outward. Hence, add 4 and 3, getting 7; from 7, subtract 2, leaving 5; to 8, add 5, getting 13; multiply 13 by 14, getting 182; from 182, subtract 2, thus leaving 180; and $180 \times 2 = 360 =$ answer. Inspect the following: 2^2, 3^3, 10^3, a^2, b^3. The small number to the right and above the given number is called the exponent of the number and denotes how many times the given number is to be taken as a factor. Thus: $2^2 = 2 \times 2$; $3^3 = 3 \times 3$; $10^3 = 10 \times 10 \times 10$; $a^2 = a \times a$; and $b^3 = b \times b \times b$. Exponents may be either numerical or literal. In general formula solution they are usually numerical.

We will now consider the basic and conventional rules for the order of precedence of operations. Let us inspect the following: $20 + 4 \times 2 = ?$ $16 \div 8 + 4 \times 2 \times 3 - 16 \times 2 \div 4 = ?$ If we add 4 to 20, we get 24. Multiplying this by 2 we get 48. If we multiply 4 by 2 first and then add 20, we get 28. In the second problem, several different answers may be obtained, depending, of course, upon the order in which the designated operations are performed. Now it is obvious that only one of the several answers obtainable can be correct, otherwise there would be no uniformity in mathematical work and accuracy would be impossible. The correct answer in the first problem is 28, and the second, 18. To overcome this difficulty mathematicians have adopted certain predetermined laws of precedence that must be mastered if the student is to solve successfully formulas and problems in general where a series of operations occur. These may be summed up as:

1.—In a series of additions, $8 + 6 + 2 + 8$, the addition may be performed in any order.

No. 2.—In a series of subtractions, $18 - 4 - 4 - 7$, the subtractions must be performed in order from left to right.

No. 3.—In a series of divisions, $1212 \div 2 \div 3 \div 2$, the divisions must be performed in order from left to right.

No. 4.—In a series of multiplications, $4 \times 5 \times 6 \times 2$, the multiplications may be performed in any order.

No. 5.—Series operations indicated by the multiplication, division, addition, or subtraction sign are performed in this order: Do the multiplications first, the divisions next, and lastly the additions and subtractions.

No. 6.—In any term, symbols of aggregation being absent, raising to powers and extracting roots must be performed before multiplication and division. A term is any quantity not separated by a plus or minus sign.

Trouble for Future Archæologists

There is a concrete building in Worcester, built upon the site of a factory recently destroyed by fire. The old factory was heated by steam and had the usual coils of steam pipe running around the walls or suspended from the ceiling, and after the fire these pipes were draped fantastically about the ruins. In putting up the new building the contractors used as much of the old material as possible in order to save the expense of carting it away, and among the salvage were these old steam pipes, which went into the concrete walls as reinforcing material; valves, unions, headers, fittings, etc., being allowed to remain on the pipe wherever they happened to be.

We can imagine the profound discussions and perhaps heated controversies to be spread upon the fair pages of *American Machinist*, Vol. MMMMMMCMXXIV, when the learned and archæologically minded engineers of that far distant day get to speculating upon the strange and inexplicable system of plumbing found in an early twentieth century building, excavated at or near the supposed site of the ancient city of Worcester.

The Cost of a Big Inventory

By Clifford H. French

ONE of the problems that confront the management of any large plant is that of keeping a sufficient stock on hand without tying up too much money in it. The ideal method, from this point of view, would be to have all material, both raw and finished, come into the plant at the same rate at which the product it shipped. This is, of course, impossible, so the manager must try to keep a safe margin of material to tide over delay in shipment and rail tie-ups without running up to too much expense.

One factory manager, for example, has devised a simple system by which he has reduced the raw material inventory of one department from about $300,000 to $80,000, and hopes to bring it still lower. This means a saving of $13,200 per year in interest at 6 per cent and is a distinct and positive reduction in the cost of the product.

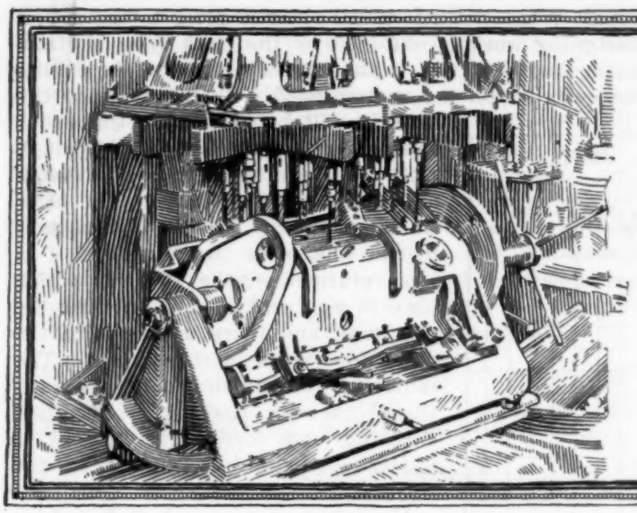
In another case I am assured that two concerns building about the same number of automobiles per year have a difference of $6,000,000 in the amount of money tied up in inventory. Interest foots up to $360,000 a year, which amounts to a little over $10 per car. Unless the large inventory carries some advantages that are not evident, the cars of this company cost $10 more to build than those of the company with the smaller inventory.

Considering the cost of inventory in this way brings us back to the facts brought out so clearly by H. P. Harrison of the Franklin Co., over a year ago. He pointed out how the use of conveyors, which kept material moving through the department, reduced the value of parts in process about one-half in their case. This factor alone might easily warrant installing conveyors, aside from the saving in labor. For, after all, we have so improved machining methods that direct labor is no longer the important factor of a few years ago.

The wise manager, however, knows that conveyors as well as everything else, must be installed intelligently if they are to prove profitable. Mr. Harrison was brave enough to tell of his failures as well as successes. And it is difficult to determine which information is of the most value. For in installing conveyors as with other plant equipment, we must consider their operation under a minimum schedule as well as when things are moving at top speed.

Then, too, the manager must determine whether it is not cheaper to increase the inventory during a dull period by piling up a stock of some parts to have them ready for the next demand. Some managers consider it better to store labor on parts requiring a minimum of material, both to have units ready for assembly and to assist in maintaining the organization of skilled workers.

All of which shows that the problems of the factory manager are by no means confined to mechanical matters and methods.



Tool Engineering

By
Albert A. Dowd
and
Frank W. Curtis

Last Article of the Series—Records Necessary in the Tool Drafting Room—Time and Progress Records—Supervision of the Drafting Room

WHEN tool drawings are made it is necessary to keep a record of the number of hours consumed by the tool designer, detailer and checker, no matter whether the work is done for an outside customer or for the factory itself. If a time clock is used, the draftsman simply "punches the clock" when he starts the work and when he completes it. The card which he uses records the amount of time consumed. Some drafting rooms do not use a time clock, and when this is the case the time may be recorded by using a time slip like that shown in Fig. 593. A slip of this kind is made out each day by every draftsman and the

BLANK MFG.CO.

DATE 8/21-22

NAME Charles Smith

JOB Drill Jig for Transmission Case Cover

JOB NO. 963 TOOL NO. T-1390

DES. HRS. 8 DETAIL HRS.

CHECK HRS. CHANGES HRS.

STRAIGHT TIME OVERTIME

Fig. 593—Draftsman's tool time slip

slips are turned in at night to the chief draftsman. All necessary information is included on the slip, so that the time records for the jobs can be properly kept.

When work is done for an outside customer the record of time used is particularly important, and while there are many systems in use, the writers have found the method shown in Fig. 594 to work out very well for a drafting room of seventy-five men. As the time slips are turned in each day, the clerk transfers the time from the time slips shown in Fig. 593, to the time record card shown in Fig. 594. This record is indexed on a card according to the job number, and under each job number the tool numbers are arranged consecutively, so that they can be very readily found.

At the end of each week the total number of hours is given separately for designing, detailing, and check-

Job No. 963 Tool No. T-1390

Customer Smith and Brown P. O. No. A-4396

Name of Tool: Drill Jig for Transmission Case Cover Part No. 5-23

1922	DESIGNING		DETAILING		CHECKING		GRAND WEEKLY TOTAL
	DAILY	TOTAL	DAILY	TOTAL	DAILY	TOTAL	
SAT. 8/21	8						
SUN.							
MON. 8/23	8						
TUE. 8/24							
WED. 8/25			8				
THUR. 8/26			8				
FRI. 8/27			4½				
TOTAL HOURS	16		20½				36½@1.50
TOTAL AM'T.							54.75
SAT. 8/28							
SUN.							
MON. 8/30					3		
TUE. 8/31			2				
WED.							
THUR.							
FRI.							
TOTAL HOURS			2		3		5@1.50
TOTAL AM'T.							7.50
SAT.							
SUN.							
MON.							
TUE.							
WED.							
THUR.							
FRI.							
TOTAL HOURS							
TOTAL AM'T							

Fig. 594—Time record for jobs

For the authors' forthcoming book. All rights reserved.

ing, and if the job extends over several weeks provision is made on the card to so record it. Thus, a detailed record of all the time consumed on any one job is immediately available by a reference to these cards.

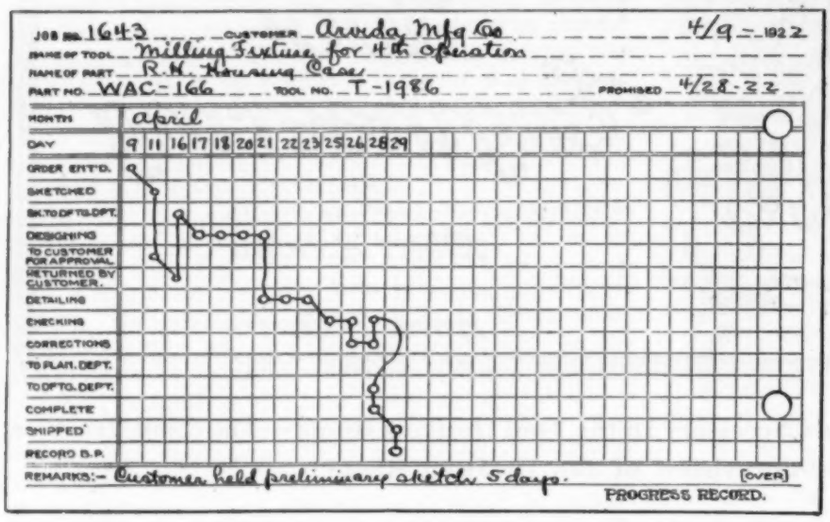


Fig. 595—Progress record of tool designing work

When billing the time to the customer, the clerk can take it directly from the card, as all necessary information is given here. Naturally the arrangements which have been made with a customer for payment may affect the billing to some extent, but the time records should be kept carefully in all cases.

One of the greatest problems of the tool supervisor is to avoid delay in getting out fixtures, and when there are a great many jobs in the works at one time, it is of the greatest importance to make sure that the various fixtures are pushed through to completion without unnecessary delay. The card shown in Fig. 595 was designed for the purpose of keeping track of all jobs in process, and also to provide a permanent record on which can be shown reasons for delay or any extraordinary circumstances having to do with the design and detailing of tools. The record is graphical for the most part, but there is space on the back of the card for copious notes when they are necessary.

The various items shown in the column at the left-hand side of the card may be changed to suit different factory conditions, but the routing as given here has been found very satisfactory to trace work, starting from the planning department and carrying it through to completion. Referring to the card, it will be seen that all necessary information regarding the name of the fixture, tool number, name of part, etc., is given at the top of the card. In addition to this, the date when the order is promised is specified at the right-hand side of the card.

In using this record the clerk is guided entirely by the time slips shown in Fig. 593, and he makes entries according to the information given on these slips. Whatever information comes prior to the actual designing work is obtained by the clerk from the tool supervisor or the planning department, depending somewhat upon the system used. By referring to the card it will be seen that the order shown here was entered on April 9, 1922, and that a preliminary sketch of the tool was made on the 11th. On the same day, the sketch was sent to the customer for approval. It was returned on the 16th, at which time it was sent to the drafting department, and there on the 17th the designing work was started. The course of the drawing can be readily traced through designing, detailing, checking and correcting until it is finally turned in completed and shipped.

Having used a record of this kind to keep track of something like 1,200 jobs, the writers can state with confidence that it is of the greatest value. A follow-up system which keeps track of the promise dates can be used in connection with the progress card to good advantage, and any delays can be immediately looked into by the tool supervisor. When a great amount of work is passing through the department, a record of this sort is invaluable.

Any drafting room employing a number of men should keep a card record to show each man's length of service, his rate per week or hour, and a brief record of his previous experience. Records of this kind can be used both as an application form for new men and as a permanent record after they have become employees. It is advisable to give the date when a man starts work and any other information which seems desirable when making out the card for a permanent record. If prefered, these records can be written on the typewriter in order to make them clearer and keep them more uniform in style. When the draftsman's term of service expires, a notation should be made on the card to complete the records, and the reason for his leaving should also be given.

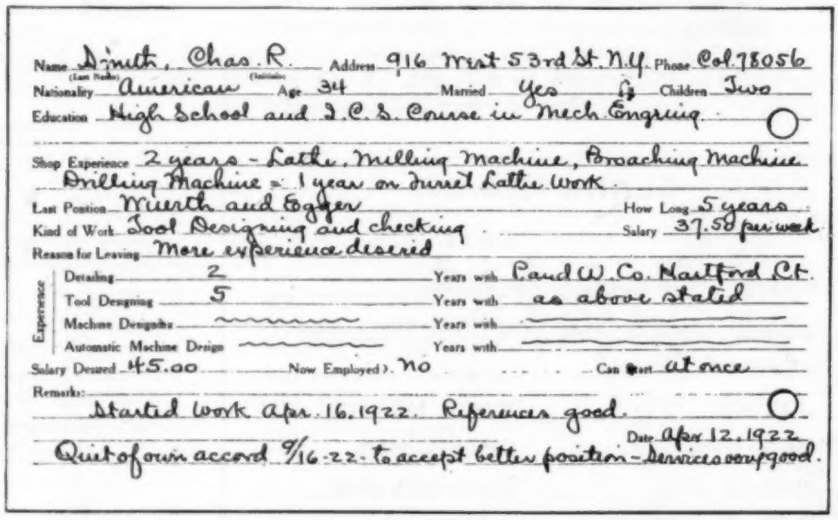

Name (Last Name) Smith, Chas. R. Address 916 West 53rd St. N.Y. Phone Col 78056
Nationality American Age 34 Married Yes Children Two
Education High School and I.C.S. Course in Mech. Engrng.
Shop Experience 2 years - Lathe, Milling Machine, Broaching Machine, Drilling Machine - 1 year on Turret Lathe Work.
Last Position Muerth and Egger How Long 5 years
Kind of Work Tool Designing and checking Salary 37.50 per week
Reason for Leaving More experience desired
Experience
Detailing 2 Years with Land W. Co. Hartford Ct.
Tool Designing 5 Years with as above stated
Machine Designing Years with
Automatic Machine Design Years with
Salary Desired 45.00 Now Employed? No Can Start at once
Remarks:
Started work Apr. 16. 1922. References good.
Quit of own accord 9/16-22- to accept better position - Services very good.
Date Apr. 12. 1922

Fig. 596—Draftsman's card record of service

The matter of supervision in the drafting room is an important one, and yet we do not wish to dwell upon the subject to any great extent. Any group of men working together in the same room on work of this kind are inclined to be a little dilatory in their methods unless rather strict rules are enforced. It is usually better to divide the men into groups of four to six under the control of a "gang boss," who is usually a lay-out man and who is responsible in some degree for his men's behavior. The supervision over the whole room should be taken care of by the assistant tool designers, who in their turn, are subject to the control of the chief draftsman. Efficient tool work can only be obtained by concentration on the work and the reduction of lost time to a minimum. A great deal of time can be spent by a group of men in discussing the best method of making a tool or fixture; and while this time may not be actually wasted, it is not production time, and the men in the drafting room are not paid for this kind of work. The tool supervisor, chief draftsman and assistants are paid for their knowledge of design and their ability on this class of work. It is their duty to straighten out knotty problems before the latter are placed in the drafting room, and much time will be saved by a settlement in advance of any questions as to design which are likely to arise.

Standardizing Tolerances for Taps—Discussion

By Charles C. Winter
Assistant Superintendent, Winter Bros. Co.

THERE recently appeared on page 217, Vol. 60, of the *American Machinist*, an article entitled "Standardizing Tolerances for Taps" by Walter Daley and, having personally assisted in the work of making out some of the tables of "Commercial Standards as adopted by the Tap and Die Institute," I am led to believe that Mr. Daley has looked at them in the wrong light. He analyzes these tables of commercial standards by the following set of rules:

1—Limits and tolerances must increase as the tap diameter increases.
2—Limits and tolerances must increase as the number of threads per inch decrease.
3—Limits and tolerances of nut and tapper taps must be greater than for hand taps.
4—Limits and tolerances on outside diameter must be greater than those on the pitch diameters.

In my opinion Mr. Daley has made a poor choice of his terms in these rules or has failed to elaborate enough on his use of them. The term "limits" as properly used means two sizes expressed by positive dimensions, the larger being termed the maximum or high and the smaller the minimum or low. "Tolerance" is a definite difference in the limit dimensions of either part, prescribed in order to limit the variations in manufacture permissible for a given fit. Therefore, the expression "limits must increase" really means nothing. Furthermore, the lead tolerance, the most important element of threaded work, has been neglected although this may have been intentional. The Tap and Die Institute standard permits a maximum lead error of ±0.003 in. in one inch of thread.

After considering the above, it might be well to increase Mr. Daley's four rules to five and have them read as follows:

1—(a) Low limit on outside and pitch diameter should increase over basic as tap diameters increase. (b) Tolerances on outside and pitch diameter should increase as tap diameters increase.
2—(a) Low limit on outside and pitch diameter should increase over basic as number of threads per inch decrease. (b) Tolerance on outside and pitch diameter should increase as number of threads per inch decrease.
3—(a) Low limit of outside and pitch diameters of nut and tapper taps should be a larger amount over basic than the corresponding figure for hand taps. (b) Tolerances on the outside and pitch diameters of nut and tapper taps should be greater than on hand taps.
4—(a) Low limit on the outside diameter should be a larger amount over basic than the low limit on the pitch diameter. (b) Tolerance on the outside diameter should be greater than on the pitch diameter.
5—Lead tolerance should decrease as the diameter and length of engagement increase.

Until recent years the above five rules have covered the ground very well from a theoretical standpoint, and they are practically what the National Screw Thread Commission and the Committee on Limits and Tolerances in Screw Thread Fits of the A.S.M.E. used in making out their first progress reports. Anyone familiar with the several reports of these committees will note that each report has become less theoretical and more practical, until they have finally recommended the use of taps made to the tables of the Tap and Die Institute for certain classes of fits.

The committee of the Tap and Die Institute started out on practically the same basis, but they came down to earth sooner, as they had this sixth rule to contend with:

6—Tables for commercial taps must be varied to meet the following conditions:
(a) Quantity demand
(b) Class of work
(c) Selling price
(d) Limits permissible on account of hardenind changes in steel and other variables beyond the tap makers' control.

Mr. Daley in his Table I has merely gone over, on one class of work only, the same old ground as the above committees, with the exception before noted, that he has paid no attention to lead troubles which would undoubtedly arise if he used some of the fine thread taps he lists.

Quantity demand which radically affects the selling price has always brought the following classes of threads to the fore:

(a) Bolt and rough iron work for which nut and tapper taps are suitable, U. S. S. threads being used.
(b) Tapped holes in which cap screws, set screws, etc., are to enter, and for which hand taps having U. S. S. threads are suitable.
(c) Tapped holes for machine screws which require an easy assembly and for which machine screw taps are used.

With the advent of the automobile, however, a demand arose for better and stronger bolts and for a class that would not jar loose so easily under the many vibrations and strains to which automobile parts are subjected. Mr. Daley has overlooked the demands for this class of work when he points out what he calls the only inconsistency in the tables. Recently,

owing to the continued call from automobile makers for smaller nut and tapper taps, the Tap and Die Institute has made this standpoint even more inconsistent by changing the tolerances of S.A.E. nut and tapper taps to the same as those for S.A.E. hand taps. The class of work on which machine screw taps are used has also been overlooked, when he says the tables for them are inconsistent with the rest of the tables.

COMMERCIAL STANDARDS NOT ARBITRARY

Rule 6, item (d), is the answer to Mr. Daley's criticism of the statement "Taps with pitch coarser than S.A.E. Standard will take U. S. Standard tolerances. Those with pitches finer than S.A.E. Standard will take S.A.E. Standard tolerances." The Commercial Standards of the Tap and Die Institute make no attempt to tell people what limits they can adopt, they merely set up a recognized trade custom which can be referred to when a customer fails to specify limits. It lies with the manufacturer to set the greatest tolerance on his product he can give and, if unable to use commercial taps, to pay for this better class of work which he needs.

The 1½-40 U.S.F. tap referred to in Mr. Daley's article would from any tap manufacturer's point of view be strictly special, and the limits which would be taken from the table for this size tap may seem "absurd" and look large until the item of lead is considered. If this 1½-40 tap was 0.003 in. long or short in the lead and the hole to be tapped was one inch long, the pitch diameter of the hole would have to be 0.0051 in. oversize before a standard plug would go entirely throught it. Here is the weak spot in the tables and the reason for rule 5. This condition is well recognized by the tap manufacturers and, by the use of some of the best grades of steel, highly specialized machinery and carefully studied heat treating methods, they try to obviate it but succeed only to a limited extent.

This condition caused tap manufacturers to start grinding threads on taps after hardening and, after several years of study, ground thread taps have been put on the market and are greatly in demand for some classes of work. Specialized grinding machinery has been developed which has brought the price of this class of tap down to a point where it can be used commercially, when a good grade of fit is required. As in every new thing, tolerances on this class of tap have been carried to extremes by some, yet they fill a long felt want.

Simplification of Forged Tools

Action taken at a meeting of manufacturers, distributors, users and others under the auspices of the Simplified Practice Division of the Department of Commerce, the American Engineering Standards Committee and the United States Chamber of Commerce, on Feb. 11, brought about a reduction in the varieties of forged tools from 549 to 365, an elimination of approximately 34 per cent. This broad classification of forged tools comprise such items as picks, mattocks, hoes, sledges, mauls, crow-bars, wedges and various blacksmith's tools. The simplified schedule is to become effective for all production on July 1, and is subject to annual review and revision by the committee of manufacturers and other interests.

Common car oil is used in hydraulic press cylinders on some railroads. The practice of using alcohol, even to thin the oil, has been abandoned in many cases.

Motor Shop Problems

Finishing Cylinder Bores

BY FRANK C. HUDSON

THE METHOD of finishing cylinder bores has undergone many changes during the past 20 years. Reaming gave way to lapping and then to grinding, which was heralded as the last word in cylinder finish. And in the eyes of many, this still remains the ideal finish.

Rolling or burnishing, and honing, are, however, being widely used by some builders, who contend that the results are highly satisfactory. A few such as Rolls-Royce and Lincoln, are even honing after the grinding, believing that the cylinder wall is brought enough nearer perfection to warrant the extra cost.

In most cases the honing is almost a polishing operation, as the abrasive stones are very fine, about No. 180 grain, and float in their holders. This prevents any attempt toward correcting the bore, and in fact no correction is intended.

There is, however, at least one shop where the honing method used is a corrective process. Honing is hardly the correct name for it. The hones are rigidly and accurately fixed in their holder and are of comparatively coarse grain. They finish a cylinder from the final reaming which leaves from 0.005 to 0.010 in. and also correct errors in both concentricity and straightness. Using hones of No. 60 grain the cut is fairly fast but does not leave as pretty a hole as the finer grain hones. This could be obviated by a second honing with No. 180 hones as is common practice.

Regardless of the final method of finishing, there is a change in practice in the final boring or reaming of the cylinders. Instead of finish reaming all the bores in the cylinder block at once, it is found better to finish ream them all with one reamer. The reason is that it is next to impossible to keep four or six reamers all the same size.

By finishing with one reamer bores in the same block seem practically uniform and whether they are ground afterward or not, it saves considerable labor in assembling. If the bores are ground, the grinder has a uniform amount of metal to remove from each, which reduces both his time and the wear of wheels.

When it comes to assembling the motor, there is no necessity to select pistons for each cylinder bore, as all bores are well within accepted tolerances for the same diameter. Pistons that will give the desired clearance for each cylinder can be selected from the same lot. And, though the variation would be small in any case, there will be better balancing of the piston weights.

This method of using a single reamer for finishing is not confined to cylinders. It is also used in reaming the holes for valve stems, valve lifter guides and in other places. Greater uniformity is secured which more than counterbalances the extra time taken in machining. For it must be remembered that it takes more time to set four or six reamers than one, and that when one reamer dulls, breaks or wears below size, it means stopping the whole group until changes are made.

All of which goes to show that it is very easy to carry the idea of multiple tooling beyond the economical limit when we consider the whole problem instead of just the machining time.

Ideas from Practical Men

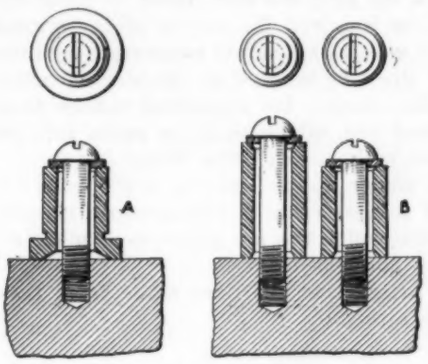
Devoted to the exchange of information on useful methods. Its scope includes all divisions of the machine building industry, from drafting room to shipping platform. The articles are made up from letters submitted from all over the world. Descriptions of methods or devices that have proved their value are carefully considered, and those published are paid for

Improved Type of Toolmaker's Buttons—Discussion

BY EDWARD HELLER

I cannot see the advantage to be derived from the use of the "improved" type of buttons described by R. H. Kasper on page 28, Vol. 60, of the *American Machinist*.

If the object sought is to get very close to a corner, why not use a button of very small diameter, or, if a broad base on the button is desired, why not make it with a flange as shown at *A* in the sketch? It seems to me that a button of this type would serve the purpose quite as well and would be much easier to make.



Special types of buttons

Mr. Kasper does not explain how he can "button" two holes that are very close together with the improved type of button. It would seem that, since they have to be of larger diameter than ordinary, it would not be possible to set them so close together.

By having one button of a set from $\frac{1}{8}$ to $\frac{3}{16}$ in. longer than the remainder a pair may be set so close together as almost to touch, as at *B*, and still allow the use of an indicator on one side of each.

Emergency Repair for a Locomotive Pedestal

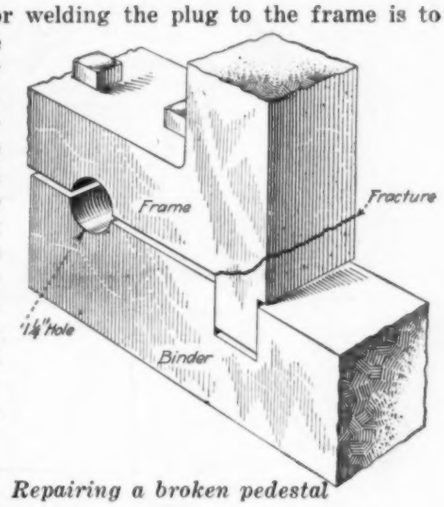
BY F. M. A'HEARN

A frequent form of breakage of locomotive frame pedestals is the failure of the binder lug, or toe, which leaves the frame unsupported at the openings of the pedestal jaw along the line of the lower rail of the frame; the condition usually being something like that illustrated in the accompanying sketch.

To avoid the necessity for holding the locomotive out of service for a sufficient time to remove the wheels and make a permanent repair, a very rigid fastening can be made in the following manner:

Force the binder, to bring the broken part as near to its original position as possible. Then drill a 1- or 1¼-in. hole transversely through the bottom rail of the frame and the binder, removing an equal amount of stock from each piece. A tight fitting plug should be driven into the hole and allowed to project slightly beyond the frame at each end, after which it may be welded to the frame but not to the binder. With the binder bolts drawn tight the plug should support the frame until the locomotive is shopped for general repairs.

The reason for welding the plug to the frame is to hold it in place when the binder is taken down. Should the opening between the binder and frame be too large to support the point of the drill, a liner, or shim, may be inserted between the parts to overcome any tendency of the drill to crowd.



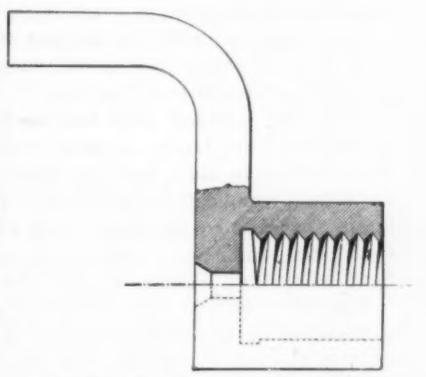
Repairing a broken pedestal

Heavy locomotives have been repaired in the manner described, and kept in service for 30,000 miles without requiring any further attention to the broken part.

Lathe Dog for Fitting Bolts

BY G. CHARLES HOEY

Quite often, due to various causes, one does not at first make a taper bolt a correct fit by turning, and then a small amount of filing is necessary. The center in the threaded end is often ruined by driving the bolt out of the hole, when trying the fit. By using the dog shown in the illustration the bolt can be put back in the lathe, where it will run true enough to be filed to a fit.



Lathe dog for repair work

Quite often one must use an old bolt and file or turn it to fit. By using this dog, one can at least make the bolt run true with the threaded portion.

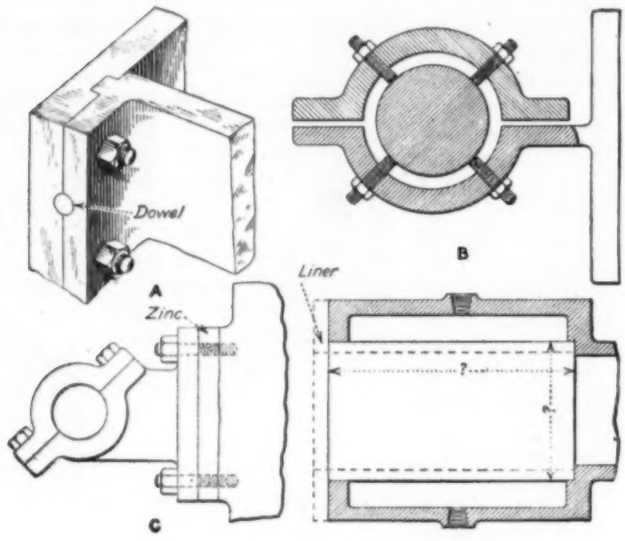
Old Bill's Short Cuts

By Joe V. Romig

Old Bill, the layer out, was a human encyclopedia of mechanics and general machine practice, and although only rated on the pay roll as an ordinary mechanic, he allowed each and every one of us to tap his till of knowledge when we were up against it.

Some of his short cuts and methods are illustrated in the sketches shown herewith. Blueprints rarely show or call for the doweling of built-up machinery parts, which, due to their size and weight, must be knocked down for shipment. It is in the reassembling that the dowel makes the accurate locating of all parts possible.

Besides numbering all his adjacent and mating castings with large stamped numerals, Old Bill also doweled



Some of Old Bill's methods

such parts as he saw fit, whether the drawing called for such doweling or not. He always used straight, round dowels, fitted half and half in each adjoining piece, as shown at *A*.

Such dowels can be depended on to hold all the parts in alignment until the whole assembly is drawn up tight and snug with the bolts and screws.

Rather than see one of our erecting men try to babbitt a bearing for a shaft high up from the floor on a large machine, with the danger of carrying his melted babbitt up a shaky ladder, Bill taught him the trick of pouring a "transferred bearing."

After the bearing shell had been drilled and doweled to the machine frame, it was removed and four holes were drilled in each half, as shown at *B*. These holes were then tapped for ½-in. studs. The bearing shell was again fastened to the frame and with the shaft in position, the studs were tightened and locked with jam nuts when they lightly touched the shaft.

The bearing was then taken down on the bench, and a mandrel of the same diameter as the shaft was laid on the tips of the studs, and the babbitt poured with safety.

On heavy machinery it is almost impossible to machine the faces of all the little bosses and pads, upon which are mounted the various attachments that go to make up the equipment of the finished machine, and such as are left unmachined, must be chipped and dressed by hand.

While others were spending hours of hard work chipping and filing, Old Bill would laugh at them and fit his bosses and attachments in his own quick and efficient way.

After ascertaining roughly the amount of metal to be removed he would rough chip the boss at least ⅛ in. lower than necessary. After drilling and tapping his bolt or stud holes, he would fit on the bearing or lever, etc. and align it to the other parts, either using little blocks of metal or small studs. When in correct alignment, he would lute around the edges with clay, and pour the cavity full of zinc, as shown at *C*.

This trick he would do in less than half the time it took others to chip and file bosses or pads of a similar size to the proper height.

Bill never liked to see anyone drive in a bushing with a sledge hammer. His advice was, "Use the press, that's what we have her for." The press allows one to check the squareness of the entering bushing, while it is doing the hard work itself. It also pushes evenly over the whole area.

Seeing me pack my grip one day, prior to going out on a trouble job, he inquired the nature of my errand. When told that I was going out to measure a cylinder casing for a new liner, he laughed at the idea of taking calipers and scales along. He suggested rather three pieces of ⅜-in. steel rod, which could be made into pin gages on the spot with a very little filing.

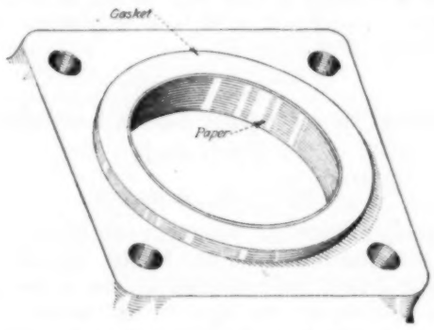
Following his advice I was able to bring back the measurements in a most reliable and accurate manner. The dimensions for which the pin gages were made are indicated at *D* by question marks.

It is needless to say that the liner made from these pin gages fit to a nicety.

Holding Gaskets in Repair Work

By Chester H. Franklin

A leak recently developed in a cast-iron boiler used for heating the shop, and, picking a mild day, we proceeded to repair it. The leak proved to be in a gasket between the boiler and a main connection, the joint



Holding gasket on boiler

being perfectly flat between the boiler and the bolted-type flange.

In spite of letting the fire die down, the steam pipe to be handled was far too warm for comfort, and it became necessary to cool it as rapidly as possible. Pouring water on it had little effect, so an electric fan was borrowed from the office and set so as to blow directly on the pipe to be cooled. Fifteen minutes of

this had the desired effect, as it cooled the pipe very rapidly.

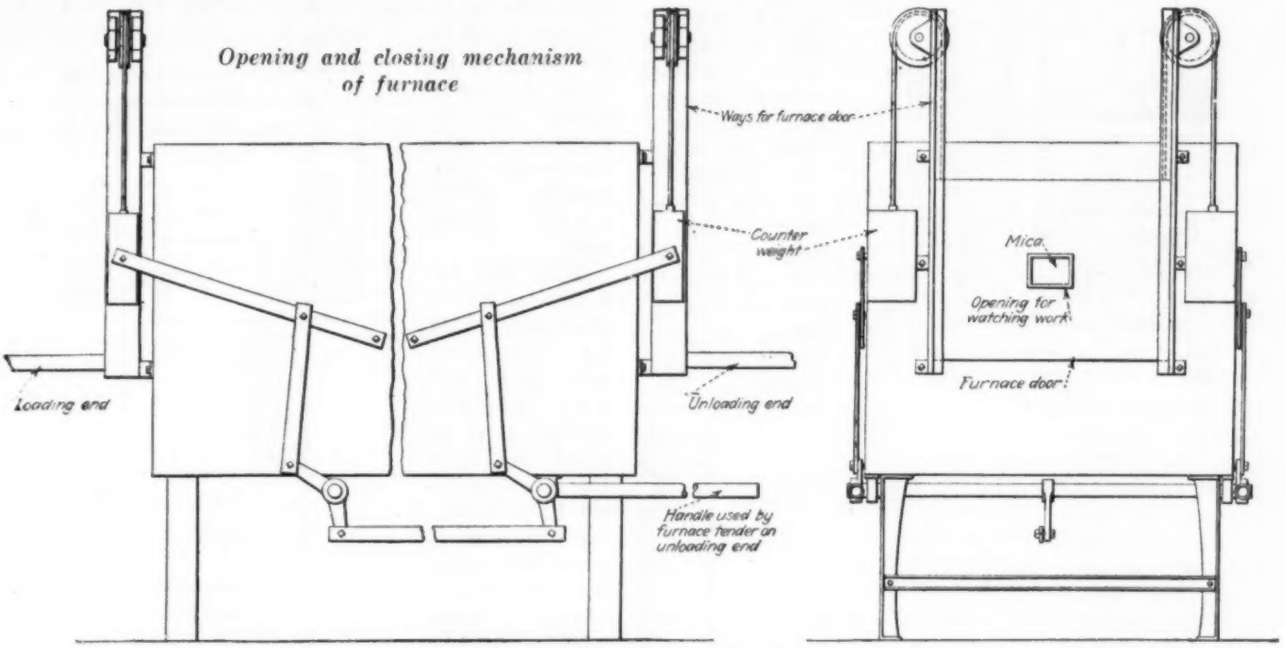
It was easy enough to remove the flange and cut out a new gasket but it was not so easy to hold the gasket in position while putting the flange back in place. After trying to stick the gasket on the boiler with shellac while the flange was being put in place, and having the gasket slide out of position two or three times, one of the boys had the bright idea illustrated herewith.

He cut a strip of heavy wrapping paper about ¾ in. wide and approximately as long as the circumference of the hole. He bent this into a circle, pushed it in the hole in the boiler, and simply hung the gasket on the projecting paper as shown. This worked perfectly and there was no further trouble.

Sliding Doors vs. Chains on Tempering Furnaces

By Joseph M. Schappert and Fred H. Korff

Until a few months ago our tempering furnaces were equipped with chains hanging from the tops of the openings, and through these chains, pieces were put into and taken out of the furnaces.



Upon investigation, we found the following conditions: Much heat was lost through the chains. It was necessary to keep ten gas burners going continuously in each furnace in order to maintain a continuous and even temperature. Heat control by pyrometer was not practicable. We were getting coagulated liquid matter on the bent portions of our work, necessitating several sand blastings before it was clean. The labor efficiency of the furnace tenders was low, due to their exposure to heat coming out between chains. The chains were expensive to maintain, as their life was very short. To make conditions better we developed sliding doors for each furnace, as shown in the accompanying drawing.

With the sliding doors the proper temperature is maintained by the use of ten burners for 1.3 hours, only in the morning to obtain proper heat in cold furnace, and from then on five burners are shut off and only five are used for the balance of the day (7.7 hours)—giving an average of 5.7 burners in use per hour. We maintain a proper even heat in each furnace by means of pyrometer control—the thermo-couple being installed through the roof of the furnace, and hooked up with a registering panel from which the temperature in each furnace may be ascertained at once. The Brown pyrometer system is used. The thermo-couples are tested to 1,800 degrees. The sliding door apparatus is so designed that, by a light pull on a handle at one end of the furnace, two doors (one at each end of the furnace) are lifted or lowered at the same time. This allows the man at the unloading end to take the pieces out after they have been tempered, and the man at the loading end to put untempered pieces into furnace. When the full load of pieces is in the furnace, a slight movement of the handle by the furnace tender at the unloading end, closes the doors at both ends. The furnace in this way holds a more even temperature at all times and, instead of the coagulated liquid matter as mentioned with the chain method, we now get a dry scale which requires but one sandblast to clean the piece, instead of from two to three sandblastings as formerly.

When chains were used, the total yearly gas consumption for all our furnaces was 8,433,180 cu.ft. Since the sliding doors were installed the gas consumption has been reduced to 4,806,912 cu.ft., or a saving of 3,626,268 cu.ft., which at $1.20 per thousand cu.ft. amounts to $4,351.53 per year.

Attaching Abrasive Disks

By E. W. Riesbeck

The other day we found that we were all out of the special cement that we usually use to "glue" the abrasive disks to the cast-iron faceplate of the disk-grinding machine, and as we wanted a new disk without delay we used shellac, with better results than we get from the cement.

Put the shellac on the disks only, not on the cast iron, place them on the cast-iron disk, and place immediately under a heavy weight of suitable shape, or in the press provided for that purpose.

Multiplying Recess Gage

BY ALBERT A. DOWD

Inside recesses can be gaged by calipers, although it is difficult to measure the diameter accurately due to the "squeezing-in" of the calipers when withdrawing them from the work. In production, when a piece is to be undercut, it is necessary to provide some form of gage that will give an accurate reading for the diameter.

In Fig. 1 there is shown a gage for measuring the diameter of the recess *A*. The body of the gage *B*, is in the form of a plug which fits the hole in the work and is relieved at *C* so that it bears only at *D* and *E*. The shouldered portion rests on top of the work and is knurled as shown, so that it may be easily handled when entering and removing it from the work. The plunger *F* fits into a hole which forms a bearing at one end, and into the bushing *G* at the other. A coil spring is employed to keep the plunger in positive contact with plug *K*. The pin *H* keeps the plunger from turning. The plug *K* has an angular flat portion *L*, against which the plunger *F* bears. The up and down movement of the plug *K* is limited by the pin *M*, which enters a slot in it and also keeps it from turning in the body of the gage. A spring is used to keep this plug in an upward position. The indicating lever *O* rests in a groove *N* on the plug *K*, and pivots on the screw *P*. The plate *Q* is of angular form, and has a sector scale graduated on it as shown, so that variations in the depth of the recess show clearly by noting the position of the pointer on the scale. The tension spring *R* takes up the lost motion.

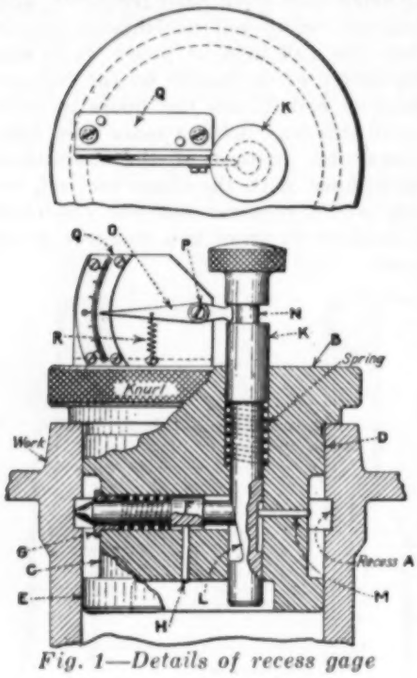


Fig. 1—Details of recess gage

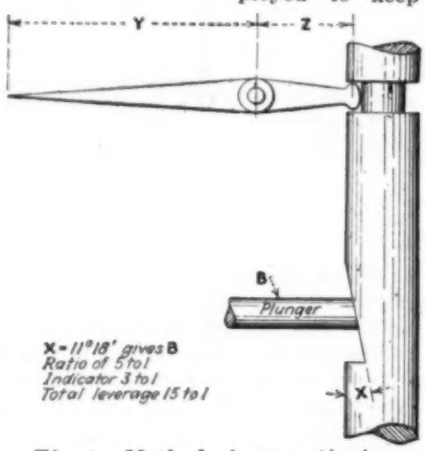


Fig. 2—Method of proportioning levers

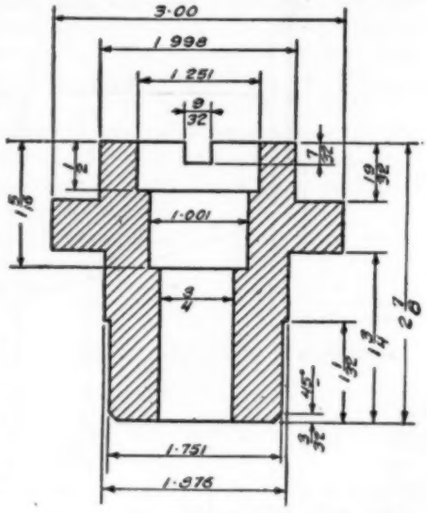
The method of figuring the ratio of this gage is very simple, and the diagram in Fig. 2 clearly shows the various proportions. If we make the angle *X* slightly over 11 deg., we find that the ratio between plug *K* and plunger *F* is approximately 5 to 1, that is, the plug would have to be forced down 0.005 in. to move the plunger 0.001 in. The ratio of the lever *O* can be made to suit, but in this case it is 3 to 1 the distance *Y* being three times that shown at *Z*. Therefore 0.001 in. movement on the plunger *F* will move the point of the lever 0.015 in. making the gage of 15 to 1 ratio.

A gage of this type can often be used to advantage in gaging shallow recesses and undercuts, by merely changing the various ratios.

Poorly Dimensioned Drawings—Discussion

BY B. L. MADDEN

On page 300, Vol. 60, of the *American Machinist*, Albert A. Dowd discusses poorly dimensioned drawings and gives an example showing good practice, together with one that he considers not so good. The information given with either of the drawings with which he illustrates his comments, is not sufficient to show what the part is, or how it should be made, but I assume that the single views are shown merely for the purpose of emphasizing the specific points under discussion.



Example of correctly dimensioned drawing

With this assumption, both drawings would be considered well made and well dimensioned; as at no point is there any doubt as to what the dimensions are or to what they refer. Such matters as limits, finish, whether holes are to be drilled, reamed or ground, etc., are presumably taken care of on some other part of the sheet.

It is advisable, of course, that all draftsmen in any one office employ identical conventions, which, in some particulars, might not be suitable for some other office. There can be no absolute right or wrong about such matters, and when we say *this* drawing is well made and dimensioned, and *that* one is not, we usually judge by the particular standards to which we are accustomed.

Judged in this way, there are as many points to be criticised in Mr. Dowd's "better dimensioned" drawing as in the "poorly dimensioned" one. Suppose we apply to the former some of the same criticisms that were applied to the latter, and observe how they have been taken care of in the drawing herewith presented.

Figures not well made: A figure 3 made curved at the top and a figure 4 made open at the top, are less apt, through carelessness or worn tracings, to deteriorate into a five and a nine respectively.

Some of the dimensions are crowded: (*a*) Spacing

dimension lines evenly is not difficult; it is simply a matter of habit. The writer's practice is to have them about ⅜ in. apart. (*b*) It is easier to draw a solid line than a broken line and easier to draw with a straight edge than free hand. (*c*) In my drawing the dimensions are placed on the line, and the line between the numerator and denominator of fractions is formed by the dimension line.

Lines running into body of drawing: This is something to avoid as a general rule, but not to the extent of making it a fetish. It is just as important to place dimensions near to the part to which they refer. If it be possible to place dimensions on the body of the drawing without interfering with either the drawing or the legibility of the dimensions, and if at the same time long position lines are made unnecessary, surely there can be no legitimate objection to their being so placed. Also, why the "short dashes and then a long broken line"? A light solid line, not quite touching the point to which it refers is much easier and more quickly made, and it serves every purpose.

The ½-in. and 45 deg. dimensioning the chamfer are better when placed together as on the "poorly dimensioned drawing," but in many cases the position lines for the angle can be dispensed with entirely, as in the drawing herewith.

Other points that might be mentioned are the cross hatching and the inch marks. Cross hatching would not be relied upon to specify the material; therefore, in details where plain hatching could cause no confusion, fancy patterns not only serve the purpose no better than plain hatching but take more time to make. Regarding the inch marks, actual experience has shown them to be entirely unnecessary on tool and machine drawings.

Too many draftsmen consider the making of elaborate drawings to be the object of their employment. In some cases it is, as when the drawings are to be used for advertising purposes, etc., but usually the primary reason for having draftsmen at all, is to prepare instructions for the shop. From this point of view, those instructions are best that give the information in a form that cannot be misunderstood, and also that require the least time in their preparation.

Putting Brass Liners in Hydraulic Jacks—Discussion

By William J. Fisher, Jr.

I was much interested in the article by Charles F. Henry upon the subject of putting brass liners in hydraulic jacks, published on page 376, Vol. 60, of the *American Machinist*, for the reason that my own work brings me constantly in contact with many hydraulically operated machines.

Instead of lining the cylinder we fit a brass sleeve over the ram, taking care to have a true, smooth bore in the sleeve and to make it a good shrink fit for the ram. The outer diameter is turned and ground to size after the shrinking operation.

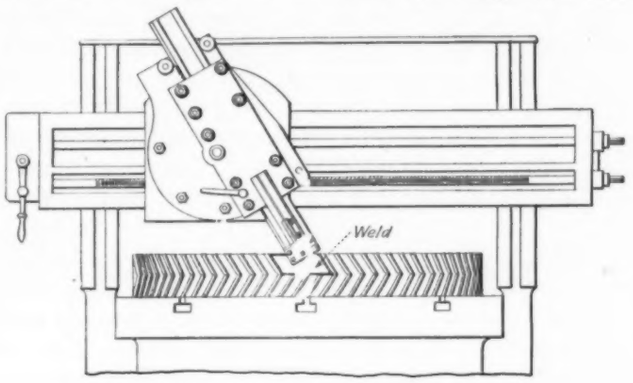
Instead of using a packing leather on the end of the ram we insert a U-leather in a recess in the cylinder about 2 in. from the top, and we are troubled with leakage, only when the leather is worn through. Although we carry very heavy pressures, we have never had a leak between the cylinder and the ram.

Salvaging a Large Herringbone Gear

By Niel Pollard

The accompanying sketch shows the method by which a large herringbone gear was salvaged in the maintenance shop of a mining company, after having a number of the teeth broken out.

Metal to replace the broken teeth was built up by means of the acetylene torch, smoothed off on the end to match the plane of the rim by filing, and laid



Repairing gear teeth on a boring mill

out from a templet made to correspond with an equal number of good teeth in an adjacent part of the rim.

The gear was then clamped in an offset position on the table of a boring mill with the repaired place under the tool-slide, and the teeth planed to line with a forming tool made to match one of the good tooth spaces. The tool-slide was equipped with a rapid power traverse, by means of which the cutting was accomplished. A special tool holder was made that permitted the tool to be fed into the cut.

The function of the boring-mill table was, of course, merely that of a work holder. To index the gear forward to cut successive teeth, it was necessary to loosen the clamps and shift its position on the table.

No claim is made that perfect teeth were produced by this method. The teeth were cut sufficiently close to line, so that with a little filing the pinion was made to roll over them without binding or play, and thus the cost of a new gear was saved.

The boring mill is often used to cut keyseats in large gears and pulleys; the rapid power traverse being very useful in such cases.

A Tapered-Bearing Problem Solved by Right Triangles—Discussion

By James Barnden
Brighton, England

In the article by Karl G. Keck, under the title given above, on page 669, Vol. 59, of the *American Machinist*, Mr. Keck certainly did not go the limit. If the taper of the spindle is 3 in 12 or 1 in 4, then in ⅛ in. it will be ⅛ in. ÷ 4, or 1/32 in., or 0.03125 in. This is the amount the diameter is to be reduced. Had Mr. Keck carried his calculations a little farther, he would have proved this to be correct, as the following will show:

$$\frac{11.875 \times 1.5}{12} = 1.484375. \quad 1.5 - 1.48375 = 0.015625,$$

the amount to be removed from one side, or 0.03125 from the diameter. I believe this method is more likely to be understood than the one given by Mr. Keck.

American Machinist
Established 1877
KENNETH H. CONDIT AND FRED H. COLVIN, *Editors*

Tax Reduction or Bonus?

AS REPORTED from the Senate Finance Committee, the revenue bill carries the tax and surtax rates recommended by Secretary Mellon. According to press dispatches Democratic forces are being marshaled to lower the minimum normal tax rate and increase the maximum surtax rate to something like forty per cent. Insurgent Republicans, not being hampered by economic facts or theories, will fight for even higher surtaxes. After the Senate finishes with the bill, it must go to the joint conference committee of the two houses and there the real revenue act will be framed.

All this will take time. Meanwhile there is every indication that an "adjusted compensation" measure will be passed and sent to the President. Should such a measure become law all the talk and effort expended on tax reduction proposals will be wasted, for tax reduction and bonus legislation are incompatible, regardless of what certain Washington demagogues may say.

American industry is suffering because capital funds are being diverted, by unreasonable surtaxes, to tax-exempt securities. If bonus legislation passes, or if the Mellon rates are not enacted into law, it will continue to suffer because any higher rates will only continue the present situation.

Are you sure your representatives in Congress understand how you feel about revenue and bonus legislation?

Production Standardization is Proposed

THE Council of the Society of Automotive Engineers is considering a proposal to organize a division of the Standards Committee of the Society to establish standards for production methods and tools. Dies, punches and jigs are suggested as desirable subjects for standardization but from such modest beginnings it would be but a step to standardization of tools and machines.

Comments by members of the Society have been asked on the following questions:

Would standardization of production materials, equipment and methods be of economic benefit?

Should the work be undertaken by a Division of the Standards Committee or taken up jointly with other engineering organizations by sectional committees operating under the rules of the American Engineering Standards Committee?

Can it be expected that the individual companies will participate actively in such standardization if it is undertaken by the Society?

It is to be hoped that no attempt at establishment of production standards will be made without calling into conference the makers of production equipment. Should such a thing happen, however, the makers would have only themselves to blame. Many efforts have been made to get them together on standardization so that they would be in a position to look after their own interests first rather than to adopt the dictates of any group of their customers.

The present proposal may come to nothing but it should be a warning to equipment builders to be prepared for other proposals that may succeed.

Repair Order Charges and the Small Shop

CONSIDERABLE attention was given to the subject of adequate charges for repair jobs at the recent regional meetings of the machine tool builders. If this subject is an important one for machine tool makers it is equally important, if not more so, to the proprietor of the small shop. In many small shops the bulk of the business consists of repair jobs of various kinds.

One of our oldest contributors says that the average machine shop man would rather work at his calling than eat, and further, that if he cannot get a fair price for his work, he is likely to do the job anyway for sheer love of doing it. This sounds rather fantastic in our sophisticated and materialistic age but it is not far from the truth if one can judge from the infrequent fortunes made in the machinery business.

It is up to the proprietor of the small shop, therefore, distasteful though it be, to do some careful figuring on what it costs him to do a job and then charge a price for it that will net him a profit. The demon "Overhead" may be the least of his worries but it is there nevertheless and demands its share of the receipts. It can never be exorcised until its habits are thoroughly understood.

Just Suppose

JUST SUPPOSE that all manufacturers of machine tools and accessories used the standard data sheets now available and sent them out to the purchasers of equipment.

If they did, tool designing could be accomplished without leaving the office. Shop layout could be made from the swivel chair. Arbors, mandrels, slot-bolts and such parts could be ordered without making a single measurement. Time study and price setting would be greatly facilitated. All these benefits and others would save real money for the user, and for the builder too, because he is a user as well as a builder.

A few will adopt the sheets, you say? And the others are too conservative? Well perhaps, but you never can tell—

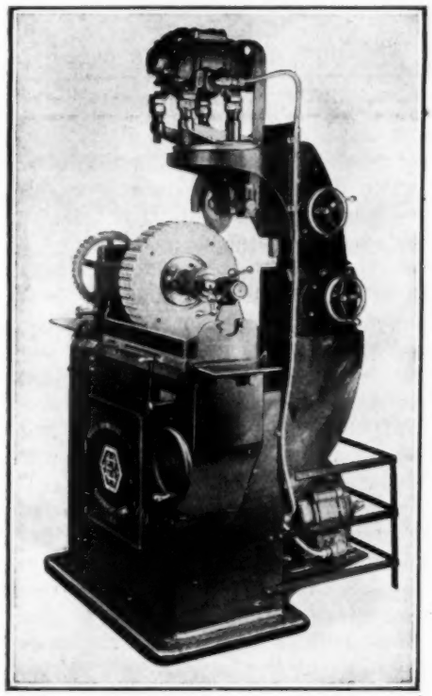
Just suppose.

Russia is 95 per cent agricultural and 5 per cent industrial, with agriculture still on the increase. If, in the face of a warning such as these figures constitute, manufacturers of machinery insist upon trying to sell their products to Russia, what a falling over each other there will be. And when it comes to settlement, it takes a lot of alfalfa to pay for any kind of machine.

Shop Equipment News

Harris No. 160 Automatic Hob-Sharpening Machine

The Harris Engineering Co., Bridgeport, Conn., has recently added to its line of such equipment a No. 160 hob-sharpening machine. This machine is similar in design to the No. 815 machine, described on page 822, Vol. 58, of the *American Machinist*, but is much larger in size and will handle hobs from 6 to 16 in. in diameter. The accompanying illustration shows a 16-in. high-speed steel hob mounted on the machine. This hob has 48 flutes and weighs 280 lb., but it is stated that the machine handles this large work easily and with the necessary accuracy.



Harris No. 160 Automatic Hob-Sharpening Machine

The hob-carrying spindle is mounted in three sets of large-size, heavy-duty, Hess-Bright annular ball bearings, and the tailstock is furnished with a taper support that is also carried on a large ball bearing. Ball bearings are also used throughout in mounting the indexing mechanism, so that the indexing is quickly and easily done.

Arrangement is made for adjusting the hob to the grinding wheel so that the proper angle of the tooth faces is preserved. The motor drive for the indexing and table reverse mechanisms is mounted at the back of the machine, a reduction gear being built in the machine.

The grinding wheel head has a separate motor drive, the motor driving the spindle through an open belt. The motor is adjustably mounted on the wheel head so that the belt can be kept tight. The head has vertical and horizontal adjustments to properly position the wheel in relation to the work, and is provided with a diamond truing device for the wheel.

Provision has been made for moving the work table far enough to one side, so that the hobs may be lifted from or put into the machine by an overhead hoist, without interfering with the grinding mechanism. The machine can also be arranged for belt driving, if desired, as well as for wet grinding. It can also be made to handle either right or left-hand spiral-fluted hobs.

Barber-Colman Co. Adds Webster & Perks Grinders to Its Line

The Barber-Colman Co., Rockford, Ill., is now marketing the line of grinders formerly made by the Webster & Perks Tool Co., Springfield, Ohio.

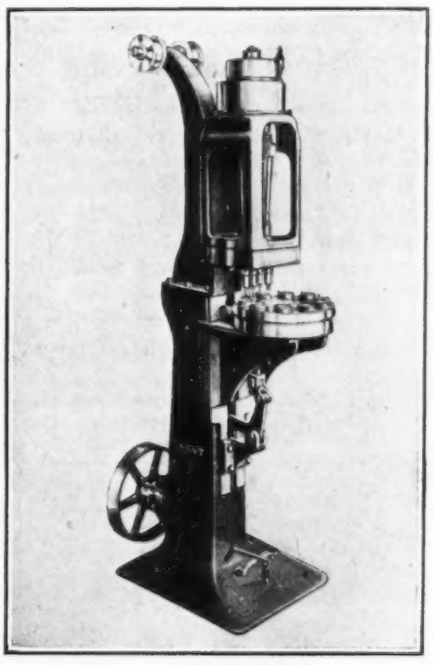
By a recent purchase the Barber-Colman Co. obtained all drawings, patterns, tools, rough castings and finished parts, and a quantity of completed machines.

Before shipment the machines will be inspected and tested under belt. The completed machines now in stock will be sold as Webster & Perks machines, but will carry the Barber-Colman machine tool guarantee.

The grinders are of the cylindrical type, and the sizes are 10 x 30 in. in the universal, and 6 x 30 in. in the plain machines.

Grant Drilling and Countersinking Machine

The multiple-spindle machine shown in the accompanying illustration has recently been placed on the market by the Grant Manufacturing & Machine Co., 85 Silliman Ave., Bridgeport, Conn., to be used for the continuous drilling and countersinking of small holes in manufactured parts. It has an indexing table, to which suitable fixtures for holding the work are attached.



Grant Drilling and Countersinking Machine

The spindles, of which any number up to six may be used, are gear-driven through universal-jointed shafts, so that the locations of the tools may be adjustable to suit the nature of the work.

The knee has a continuous, recipro-

cating, vertical movement through a distance of 1¾ in., and the indexing of the rotary table is automatically performed during each downward movement. The amplitude of the vertical movement may be changed by substituting a cam of the desired range, the rate of travel being varied through the use of change gears. A rocking treadle stops and starts the movement.

The spindles are driven by a 2-in. belt from an overhead shaft, and a second belt is required to operate the automatic feeding mechanism. The machine covers a floor space 18x35 in. and stands 5½ ft. high. Its weight is approximately 600 pounds.

Pollard Bros. Welded Factory Stools

A line of factory stools with welded frames is now being marketed by Pollard Bros., 4034 N. Tripp Ave., Chicago, Ill. The various types include stools of various heights with no height adjustment, a non-adjustable stool with swivelling seat, and stools with height adjustment. The swivel stool is shown in the accompanying illustration.

The frame is constructed of ¾x¾x¼-in. steel angles, and all joints are welded by the arc or oxy-acetylene processes. The cross-braces are ⅝x⅝x⅛-in. angles welded into the frame and two sets of braces are used for stools more than 28 in. in height. A dome-shaped foot is welded on each leg so that it will not scratch the floor and can be moved easily.

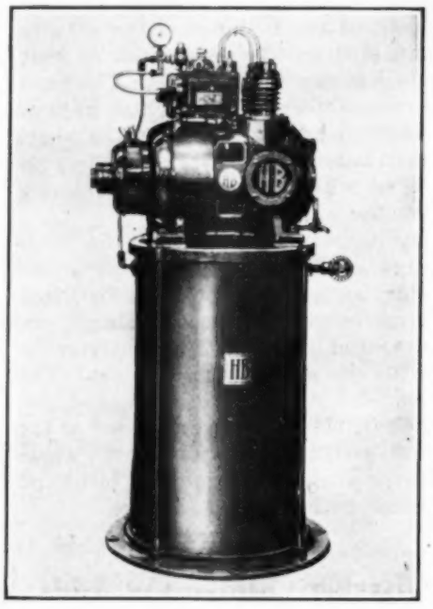
The hardwood seats are furnished in 13½- and 14½-in. diameters, and back rests can be furnished if desired, as shown in the illustration. The swivel is of malleable iron and has a long bearing. The height adjustment on the adjustable stools is made by means of an auxiliary angle arranged to fasten to the legs of the stool by machine screws. A series of screw holes make a 6-in. total height adjustment possible in 1-in. steps.

Pollard Bros. Welded Factory Stool

H B Automatic Air Compressor

A small automatic air compressor, designed especially for automobile service stations, has recently been placed on the market by the Hobart Bros. Co., Troy, Ohio. As shown in the accompanying illustration, the equipment consists of a motor-driven air pump and automatic switch, mounted on the top of a 30-gallon air tank.

The compressor has two cylinders and runs at 400 r.p.m., delivering 4 cu.ft. of air per min. The motor has ball bearings and operates at 1,200 r.p.m., being geared to the compressor through helical gears for quiet operation of the unit. The unit operates on any lighting or power circuit, the motor being furnished for alternating or direct current, as desired, and for a variety of voltages.

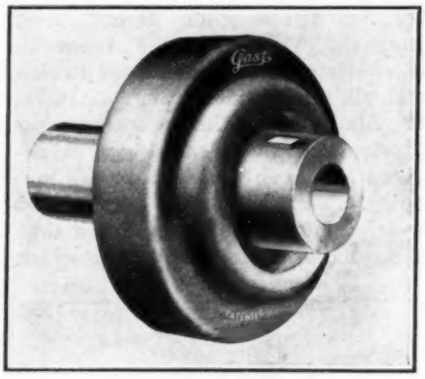


H B Automatic Air Compressor

The automatic pressure switch starts the motor when the tank pressure falls to 120 lb. per sq.in. and cuts it out again at 140 lb. per sq.in. The tank is tested at 400 lb. per sq.in. pressure. An automatic valve control allows the motor to start under practically no load. The floor space required is 2x2 ft., and the complete unit weighs 480 pounds.

"Gast" Loose Pulley Bushing

The Standard Pressed Steel Co., Jenkintown, Pa., is now marketing an oiling device for loose pulleys, known as the "Gast" loose pulley bushing. In the design of this device the difficulty of lubricating loose pulleys, on account of the effect of centrifugal force in throwing the oil outward, is recognized, and it is constructed to overcome this difficulty.



"Gast" Loose Pulley Bushing

The device has two parts, an oil reservoir with a hub that can be fastened to the shaft by means of a setscrew, and a bushing that is pressed into the loose pulley. These parts rotate in relation to each other, but are so constructed that they can not be taken apart. The bushing section extends into the reservoir section where the neck of the bushing has a rectangular opening through it to the shaft.

An endless chain is suspended from the neck and dips into the annular oil reservoir. A steady stream of oil is carried to the bushing from the reservoir by the chain as the loose pulley revolves and passes through the rectangular opening to the shaft at each revolution of the pulley. The reservoir is filled through the annular opening shown in the accompanying illustration until it reaches the gauze dust guard, and it is claimed that one filling will be sufficient for several months' operation.

Provision is made for the return of the oil to the reservoir from the bushing and it is said that no leakage will occur unless the reservoir is filled too full.

News of the Week

Attractive Program Arranged for Meeting of Gear Manufacturers

Many subjects will be discussed at Buffalo sessions

The eighth annual meeting of the American Gear Manufacturers Association will be held at the Lafayette Hotel, Buffalo, N. Y., April 28, 29 and 30.

Monday morning will be given over to committee meetings, with a meeting of the Executive Committee of the Association scheduled for 10 o'clock.

The first general session of the convention will be held at 1:30 o'clock on Monday afternoon. At this time the president of the association, George L. Markland, Jr., of the Philadelphia Gear Works will deliver an address on the subject, "The Year in Prospect." Reports of committees and sub-committees will occupy the afternoon until 4:30 o'clock, when W. E. Sykes of the Farrell Foundry & Machine Co., Buffalo, will speak on, "Gear Practice In England."

The second general session of the meeting will be held at 8 o'clock Monday evening. "What Have I Left Out?" or "The Value of Cost Accounting to an Executive" will be the address of the evening, the speaker being Russell C. Ball of the Philadelphia Gear Works.

On Tuesday morning, four members of the Executive Committee will be elected for a term of three years, after which an address will be given by L. G. Hewins, manager, Van Dorn & Dutton Co., Cleveland, Ohio, his subject being, "The Gear Manufacturer Needed."

No meetings are scheduled for Tuesday afternoon, this time being set aside for sight-seeing and visitation and for any other purpose announced by the Entertainment Committee.

The Executive Committee will meet at 5 o'clock, Tuesday for the purpose of re-organizing and electing the president of the Association.

Good Banquet Speaker

One of the features of the meetings of the American Gear Manufacturers Association is the informal banquet which is held. This will take place at 7 o'clock, April 29. An interesting program has been announced with the president of the Association, George L. Markland, Jr., acting as toastmaster. The speakers will be James B. Horn, a Russian, and S. F. Fannon of the Sherwin Service, Inc., who will speak on the subject "The Seventy-Five Cent Dollar in Business."

The fourth general session of the convention will convene at 9:30 o'clock Wednesday morning. Addresses will be made by E. S. Sawtelle of the Tool Gear Steel & Pinion Co., Cincinnati, Ohio, whose subject has not been announced; F. E. McMullen of the Gleason Works, who will speak on the "Application of Spiral Bevel Gears"; and J. C. McQuiston, advertising manager of the Westinghouse Electric & Manufacturing Co., whose subject is, "Advertising as an Investment for the Gear Manufacturer."

Group Meetings

A meeting of the Industrial Group presided over by A. F. Cook will discuss conditions in the industry as it applies to their particular group.

The closing session of the meeting will be held Wednesday afternoon at which time two addresses are scheduled. One of these will be on the subject, "Practical Metallography" by Stanley P. Rockwell, metallurgist, and the other will cover the subject, "Gears and Pinions of Equal Strength" by M. A. Durland, assistant professor of machine design, Kansas State Agricultural College.

A meeting of the Automotive Group with E. J. Frost presiding will be held during the afternoon for the purpose of discussing conditions in the automotive industry.

Colorado Fuel and Iron Spending Three Millions

Installation of modern equipment and extensive improvements at the steel mills of the Colorado Fuel & Iron Co. at Pueblo, Col., at a cost of approximately $3,000,000 were announced at the Denver offices of the company recently. The preliminary engineering work will be started at once, although the installations and improvement work will not be completed for two years, it is said.

The improvements authorized include the installation of electric precipitators for clean blast furnace gas; the installation of a new power plant including a number of high-pressure boilers with super-heaters; turbo-blowers for blast furnaces, replacing the present reciprocating engines used for the purpose and a generating plant consisting of turbo-generators and the substitution of electrical drive in some of the rolling mills instead of the steam drive now employed. The Pueblo mills will blaze a pioneer path in the use of the electric precipitating method for blast furnace gas, according to company officials. While the method has been tried out in smaller plants, the Colorado plant will be the first to use the new method on a large scale.

While the improvements will not make for the employment of any additional men permanently, production will be materially speeded up by the contemplated changes, according to those who have studied the situation.

Industrial Plank for Political Platforms

A "platform for American industry," to be presented to both political parties, will be drawn up at the twenty-ninth annual convention of the National Association of Manufacturers, which will be held at the Waldorf on May 19, 20 and 21.

Among the subjects to be discussed are taxation, immigration, railroads, merchant marine, conservation, industrial relations and the legislative outlook. The topics, it was said, will be presented by authorities in their fields.

The "platform for American industry" has been under discussion for a year by a committee headed by Charles Cheney.

Special Clinic for Industrial Cases

An industrial hygiene clinic has been established at Reconstruction Hopsital, New York City, under the joint auspices of the hospital, the College of Physicians and Surgeons and the Industrial Hygiene Division of the State Department of Labor.

The clinic will provide opportunity for the diagnosis and treatment of occupational diseases and poisonings that affect workers in many industries. Facilities will be available for physicians and workers of the entire State. Hours of consultation will be on Tuesdays and Fridays from 2 to 4 o'clock. Treatments will be given each week day from 9 to 5 o'clock, except on Saturday, when the clinic will close at noon.

C. & O. Will Build Own Hopper Cars

Construction of 3,000 hopper cars in its own shops is being considered by the Chesapeake & Ohio railroad it was reported recently. The railroad was said to be in the market for 30,000 tons of steel to be used in the work. Equipment orders recently placed included eight locomotives for the Maine Central, twelve electric engines for the Virginia and six mountain type locomotives for the El Paso & Southwestern, all of which were placed with the American Locomotive Co. The International & Great Northern ordered ten passenger cars from the American Car & Foundry Co.

A. P. Davis Receives High Praise from Nation's Leaders

Discharged reclamation head lauded by Hoover and Garfield

Never before in the history of the federal government has a discharged employee been so honored as has A. P. Davis, the former director of the Reclamation Service. His departure from Washington to reside permanently in California was made the occasion for various tributes indicative of the appreciation in which he is held by fellow engineers and by his former associates in the Bureau of Reclamation.

More than 500 engineers attended a formal dinner April 5 at which Mr. Davis was the guest of honor. The dinner was under the auspices of the District of Columbia section of the American Society of Civil Engineers and of the Washington Society of Engineers. On that occasion, Commerce Secretary Hoover, former Interior Secretary James Garfield, Carl E. Grunsky, president of the American Society of Civil Engineers, and M. O. Leighton, lauded his long and successful public service.

Despite the fact that Mr. Davis had been summarily dismissed from office by the present Secretary of the Interior, in a way intended to reflect adversely on Mr. Davis' professional ability, the employees of the Bureau over which he had presided, at the risk of displeasing the head of the Department, presented Mr. and Mrs. Davis with a solid silver service consisting of 167 pieces.

Secretary Hoover, in the course of his remarks at the banquet declared that the Bureau of Reclamation is Mr. Davis' monument. He mentioned some of the outstanding projects which had been planned and constructed by Mr. Davis and said "No one can question that he has given stature to the profession." He referred to him as being an engineer in character as well as in ability.

Former Secretary Garfield referred to Mr. Davis as a man whose "feet are constantly on the ground" and the one "who first opened my eyes to the practicality and the high idealism of engineers." In his relationships with him during the period that he was secretary, Mr. Garfield said he formed a high respect for Mr. Davis' ability and that he was always willing to accept his facts and figures. Mr. Garfield referred to Mr. Davis' work as being "of great benefit to the entire country."

Dr. Honda Visits the Industrial Centers

Dr. Kotaro Honda, professor of physics and metallurgy at the Research Institute of iron, steel and other metals Sendai, Japan, has been visiting the various industrial centers in the United States on his way to spend the summer in Germany, France and England. Traveling with Doctor Honda are two of his associates, lecturers in metallurgy, Messrs. Hiromu Takagi and Tokujiro Matsushita. These gentlemen have been the guests of various chapters of the American Society for Steel Treating in the industrial centers they have visited.

On Wednesday, April 2, in Cleveland, Professor Honda was the guest of honor of A.S.S.T. at a luncheon at the University Club, and on Thursday evening he delivered an address on the "Theory of Quenching" in the lecture room of Case School of Applied Science in Cleveland.

From Cleveland the visitors went to Pittsburgh where they were met by a committee from the Pittsburgh chapter consisting of past-president, T. D. Lynch, chairman, W. J. Merten and chairman-elect, DuRay Smith. They visited many plants in Pittsburgh and vicinity and on Friday evening, April 4, were the guests at a dinner and reception at the Pittsburgh University Club after which Doctor Honda delivered an address before the chapter in the Auditorium of the Bureau of Mines.

The Philadelphia chapter of the Society entertained the distinguished savants at a dinner on Wednesday evening, April 9, and Doctor Honda addressed the members of the chapter in the assembly room of the Engineers' Club.

From Philadelphia they went to Washington to be the guests of Doctor Burgess, director of the Bureau of Standards and president of the American Society for Steel Treating.

The three men will attend a meeting of the New York chapter on Wednesday, April 19, sailing from New York on April 21 to attend the May meeting of the Iron and Steel Institute in London. This will have been the first meeting of the Institute that Professor Honda has attended since receiving the Bessemer Medal in 1921.

Doctor Honda previously studied two years in Germany and expects to renew his old acquaintance abroad.

The party plans to return to Japan through the United States and have arranged their itinerary so that they will be present in Boston during the Convention and International Steel Exposition of the American Society for Steel Treating. Doctor Honda and his associates have prepared papers for presentation at this time which will be one of the convention's features.

British Industries Are Improving

British industry is reported improving in a cable to the Department of Commerce from Acting Commercial Attache Hugh D. Butler, London. Unemployment has reached the lowest figure since 1920. The tram strike terminated favorable to the men. Negotiations in the coal dispute are at a deadlock, with a considerable spread between the owners' offers and the miners' demands. The immediate condition of the coal market is active. The engineering trades are threatened with a lockout.

The iron and steel trades have made little progress in March because of disorganization due to fluctuating exchanges and dullness due to Continental politics and the domestic labor uncertainty. The demand for fuel from all sides has kept metallurgical coke prices high, and some works were forced to close lately. The unexpected appreciation of the franc during the last half of March cut off the serious invasion of the British market by Continental sellers and gives the home works a better outlook for the next few weeks, with some British iron sold across the Channel. The coal, shipyard, and other labor troubles obscure the outlook.

Considerable improvement was shown in the motor vehicle trade, and the production of light cars and motorcycles is estimated much heavier than March of last year. Petroleum imports are greatly exceeding last year and are expected to remain at the present rate.

Shafting Committee Makes Report

A preliminary report on the standardization of shafting has just been completed by a sub-committee of the A.S.M.E. organized under the procedure of the American Engineering Standards Committee. This committee has been at work for over four years and its work supplements that of an earlier war committee organized in 1918 to standardize shafting with a view to conserving steel.

In the preparation of this report the committee has reviewed the whole subject of shafting design, including the many theories of elastic failure. Design formulas for the general cases met with in the design of transmission shafting are included as well as the working stresses recommended for widely varying quality of shafting materials and conditions of loading.

What the Analysis Has Shown

A thorough analysis of the various theories of elastic failure indicates that for ductile ferrous material under widely varying conditions of stress, elastic failure takes place in shear and not in tension or compression. Torsion tests made upon very thin tubes seemed to indicate that the elastic limit in shear of a ductile material is almost exactly one-half of its elastic limit in tension. The conclusion reached is that the "Maximum Shear Theory" is of general application to the various conditions of stress to which a shaft may be subjected. It follows that for uniform stress distribution, the working stresses in shear should be taken as one-half of the tensile stresses.

A limited number of advance copies of the report have been prepared and are being sent out for criticism to those members of the A.S.M.E. interested in the subject. The object is to give these members an opportunity to offer criticisms before final printing. A few of these advance copies are still available and will be sent to those members interested.

Excellent Chances to Sell Machinery in South America

Latin Americans impressed with United States products

Prospects for more stable conditions in Europe bring with them the certainty of an increased amount of German competition in the machinery field. The war has brought a new realization to all business that prosperity in any country is dependent to a very considerable extent upon that in other countries. The placing of Germany on a more substantial economic basis and the removal of some of the uncertainties that have distressed other European countries since the occupation of the Ruhr, will redound, all believe, to the interest of the United States. It is expected to affect favorably the business in machinery and machine tools, but it will necessitate increased efforts to maintain and enlarge markets abroad.

American machinery manufacturers are particularly well entrenched in Latin America, officials of the Department of Commerce believe. They point to an important difference in the situation now as compared with that following the Armistice. The United States furnished most of the machinery purchased in Latin America during the war. This was during a period of high prices and at a time when the needs of the Allies and of the United States were such that Latin American orders frequently were not handled in an entirely satisfactory manner. The result was that the minute the Germans came into the market again, they recovered most of their old customers with little difficulty. The Germans, however, soon were in a worse situation than the Americans. They had difficulty in making deliveries. They had to revise prices again and again. Frequently quality was not up to representations. As a consequence, Americans again began to get the business. For the past three years deliveries have been particularly prompt and quality has been open to no criticism.

Giving Service

American manufacturers are doing another thing which is proving popular in Latin America. They are giving service on their machinery. Manufacturing in many lines is new in Latin America. The inability to secure imports during the war gave great impetus to manufacturing industries. In many communities machinery is being used for the first time. Mechanics available in such places have had no previous experience with it. Were it not for the fact that American manufacturers, frequently at an expense that would be unjustified ordinarily, have been willing to keep machinery in repair and carry in the country stocks of spare parts, operating difficulties would have been much greater than has been the case.

An American machinery salesman reporting recently to the Department of Commerce states that one of the first questions asked by prospective customers is whether or not the salesman represents German machinery. Evidently their experience since the Armistice with the Germans has been highly unsatisfactory as this salesman was informed repeatedly that they did not want to entertain any German proposals.

There is no doubt that American machinery has a prestige in Latin America never enjoyed before. The hope is expressed that this advantage can be maintained. One step that will be very helpful, it is thought, is for each manufacturer to keep in touch with the ultimate purchaser of each machine, particularly if it be of a complicated type. A letter sent to that purchaser every few months asking if the machine continues to give satisfaction is recommended as a very effective step in the maintenance of good will.

With practically no exception, American manufacturers can feel proud of any installation of American machinery in Latin America. As these installations increase, it is believed by Department of Commerce officials that the prestige already attained will be increased materially. They point out that Latin America is a market that well may be nursed. While the republics to the South of us are for the most part pastoral, their governments all trend strongly to the application of protective tariffs. This is certain to encourage new manufacturing enterprises and to maintain the prosperity of industries already established in those countries.

Just at this time, it is believed that Latin America offers particular advantages because orders generally have been withheld in the hope of securing more favorable prices. As a result, the market is at a point capable of maximum absorption.

Committees Named for Transport Congress

The World Motor Transport Congress, which will be held in Detroit May 19 to 23, is expected to be one of the most important events arranged for the purpose of improving automotive service station methods. The six most important automotive associations in the United States are sponsoring this congress. They are: The National Automobile Chamber of Commerce, the Motor and Accessory Manufacturers' Association, the Society of Automotive Engineers, the National Automobile Dealers' Association, the Automotive Equipment Association and the Service Equipment Association.

The service committee of the National Automobile Chamber of Commerce, which originated the congress, consists of Frank A. Bonham, Durant, chairman; W. M. Warner, Cadillac; A. R. Cumner, Autocar; L. C. Voyles, Marmon; F. J. Wells, Pierce-Arrow; H. R. Cobleigh, of the N. A. C. C., secretary.

S. A. Miles, manager of the New York and Chicago national automobile shows, will be the chairman and manager of the service show which will be held in conjunction with the congress. The latter will be held at the Hotel Statler, while the show will be held in the General Motors Building. Mr. Miles will be assisted by an advisory committee comprising M. L. Hemingway, general manager of the Motor and Accessory Manufacturers' Association; W. M. Webster, commissioner, A. E. A.; S. Duncan Black, S. E. A.; and H. R. Cobleigh, N. A. C. C.

Local arrangements are in the hands of B. G. Koether, director of sales section, General Motors Corp., with headquarters in Detroit.

Many Foreign Countries Want Machinery

The Port Commission of Montevideo is inviting bids for the supply of an electric winch and two electric capstans, according to recent advices from Consul Thomas H. Bevan to the Department of Commerce. Complete specifications in Spanish are on file at the New York District Office of the Bureau of Foreign and Domestic Commerce, 734 Customhouse, New York City, and are available for examination by accredited American firms. The bids will be opened on June 17, 1924.

The Victorian Railways of Australia are asking for bids for the supply of drop forging equipment to include a drop hammer battery, complete stamps, and all necessary accessories, but excluding anvil blocks and structural supports, reports Consul Norman L. Anderson of Melbourne. Tender forms, specifications, and blue prints are on file at the Chicago district office of the Bureau of Foreign and Domestic Commerce, Room 830, 76 W. Monroe St., and at the New York District Office, 734 Customhouse, for examination by prospective bidders. Tenders close at Melbourne on May 21, 1924

Catalogs of winding, spinning, and weaving machinery have been requested by Trade Commissioner W. E. Embry, in charge office of Commercial Attache, Rio de Janeiro, Brazil. This request is elicited by inquiries made at this office by certain capitalists interested in the formation of a new textile manufacturing company. American firms desiring to forward catalogs on behalf of the inquiry, may do so through the Industrial Machinery Division. Covering letters and printed matter should be marked plainly: "For the Industrial Machinery Division, Room 815. Bureau of Foreign and Domestic Commerce, Washington, D. C., for transmission to office of Commercial Attache, Rio de Janeiro, Brazil. Reference No. 322-2/29."

A representative of a branch of the Chamber of Commerce at Saloniki, Greece, has requested catalogs from American firms dealing in construction machinery and equipment. Vice Consul Howard A. Bowman states that a considerable amount of building and construction work is going on at the present time and that a demand for American construction machinery will develop. Catalogs and all concerning letters should be addressed: "To the American Consul, Saloniki, Greece. Reference No. 424."

The Business Barometer

This week's outlook in Commerce, Finance, Agriculture and Industry based on current developments

By Theodore H. Price
Editor, *Commerce and Finance*, New York

(Copyrighted, Theodore H. Price Publishing Corporation, 16 Exchange Place, New York)

BECAUSE the authors of the so called Dawes plan are Americans many of their countrymen think they can work miracles. Their scheme seems to be ingeniously simple, but it leaves two questions unsettled. One is will it be accepted by all the parties in interest? The other is what is the amount of the payment that it imposes upon Germany?

This last question—"how much?"—is in fact the crux of the whole matter. General Dawes is a good negotiator and it is probable he left it open so that there should be room for bargaining. But bargaining, especially international bargaining takes time and it is not at all unlikely that several months may elapse before any definite agreement is reached.

But this is not to say that the proposals that have been worked out with such care will be without constructive effect. They provide an elastic basis for amicable discussion and this is a great gain. But they do not settle matters and those who had hoped they would electrify the markets have been disappointed.

And just here it may be remarked that "electrified" markets seem to be a thing of the past. Cotton is the only article that seems to fluctuate sensationally these days and if the bill prohibiting short sales of cotton should be passed by Congress the electrical days of the Cotton Exchange will be ended.

But while cotton has been going up most of the other markets have been static. The brokers who earn more commissions when fluctuations are wide are naturally dissatisfied when prices are stationary. But this is not a condition that the merchant and the manufacturer object to. It is in fact just what they prefer, provided the demand keeps up—namely, steady markets with a healthy movement of goods from produced to consumer. Most people seem to have confidence in present prices, but they do not look for much advance. Therefore they are content to buy from hand to mouth and the country's production is moving from first to last hands in a fairly steady stream that is flowing smoothly and without obstruction or congestion.

It is an ideal condition for, although it furnishes no speculative excitement, it is "stabilization," which is exactly what the economists have been so long clamoring for.

Aside from cotton, which is again getting altitudinous and should now be dealt in with caution, the markets call for but little comment. Corn and wheat are a shade firmer on a better export demand. The Government puts the April 1 condition of winter wheat at 83 as against 75.2 per cent last year. The crop is estimated at 549,000,000 bushels, which is 23,000,000 bushels less than last year. The decrease is explained by the reduction in acreage.

Steel is a shade quieter. Lake ore is 80 cents lower. Copper is steady. The offtake is large but the copper experts say that higher prices depend upon an increase in the export demand. The non-ferrous metals are lower. Distributive trade is called "spotty." On the Pacific Coast it is excellent, but in the Northwest it is not so good. In the South and East it is called satisfactory but not booming. Foreign exchange advanced slightly as it became known that the Dawes report aimed at its stabilization.

If there are any really vulnerable points in an otherwise satisfactory situation they are the automobile industry and the building industry. The facts are hard to obtain but it seems to be true that the automobile manufacturers planned to produce more cars than can be sold this year. It is now believed that they will curtail their output.

The overbuilding in progress is, however, a more serious matter as it was based on costs that presuppose higher rents than the public may be willing to pay when the new structures are ready for occupancy.

Bradstreet's estimates the building expenditure for March at $334,000,000 against $325,000,000 in the same month a year ago and Dun's figures are $319,000,000 as compared with $293,000,000 in March 1923. On their face these statistics do not seem to be alarming but the F. W. Dodge Co. says that "a dangerous speculative peak" has been reached for new construction in New York City and the Dow Service building report takes the same view. In greater New York alone the expenditure for residential buildings (chiefly apartments) during the first three months of 1924 is estimated at $196,000,000 as compared with $107,000,000 a year ago.

The stock market is dull and featureless. It is absolutely without initiative and more stock brokerage firms are consolidating in an effort to cut down overhead charges against a dwindling business.

The weekly statement of the Federal Reserve Banks shows that their condition is also "static" for aside from an increase of $12,000,000 in gold holdings there are no changes that require comment.

The tranquility of business is in fact so general and unusual that there are some who insist that it cannot last, but there are no indications that it will be succeeded by storm and it seems reasonable to count upon reasonable activity with reasonable profits during the summer.

What's Doing in Industry

Business showed slight improvement in the machinery and machine tool lines in some parts of the country, although complaints have been made in other parts that April will not be any better than March. It is believed in the East that April will be a trifle better, while in Detroit, Buffalo and Chicago business will probably be of smaller volume.

General business remains good and most prognosticators see steady normal conditions ahead for merchants and manufacturers.

Building figures continue to improve and to such an extent that it has become alarming. It is pointed out that construcion is being rushed through at top prices for both labor and materials and great danger lies in over-building. But it will be remembered that many predicted that there was too much of this work being done at about this time last year.

Automobile sales show some betterment as manufacturers are making brave efforts to overcome any possibility of crowded warehouses and frozen assets. The demand on May 1 should tell the story.

The stock market seems to have settled down to a firmer level which is a trifle lower than the first few weeks of the year had indicated, but more satisfactory than the continual fluctuations of the past month.

Business has apparently become immune to politics. Daily disclosures have failed to cause anything more than a better regard for substantial surplus, a situation that strengthens rather than weakens conditions.

The Industrial Review

Progress of the machinery and machine-tool business in various parts of the country

THE following reports, gathered from the various machinery and machine tool centers of the country, indicate the trend of business in these industries and what may be expected from the future:

Buffalo

A period of uncertainty seems to be setting in for the machine tool manufacturers and dealers of the Buffalo district. None of the leading dealers feel pessimistic over the fact that there are few large orders coming through at this time, although they admit that business for the first ten days of April, has been lower than the averages for the balance of the year. Most of the orders received now are for single machines and yet there is sufficient volume of these to keep things going, the machinery men claim.

There are one or two large orders in prospect in the district and one of these is almost to a point where specifications will be sent out. Also, there are many active inquiries for tools running from two or three machines to ten or twenty, but none of them are actually being placed, most of the manufacturers apparently holding off because of uncertainties of their markets.

However, it may be that the abundance of large orders for equipment which kept business so good during 1923 and which has made the first three months of the present year very satisfactory to the machine tool trade, has spoiled the dealers for the business which they are getting now. Compared with periods during 1920, 1921 and even 1922 the run of business today is satisfactory.

Chicago

Machine tool and machinery dealers in the Chicago district report business at a lower point than for several months. A few tools have been sold out of stock. A Chicago manufacturer who has national distribution of a general line of machinery and machine tools reports that although inquiries have been received for machine tools and equipment from the oil fields, automobile accessories, general machine shops, lumber and marble interests, they are not closing and some of the lists have been withdrawn. The automobile industry is slowing up and further confirmation has been received to the statement that local automobile accessory manufacturers who are speeding up production are doing so in order to avoid cancellation of orders. Additional machinery and tools have been sold at auction to industrial users. The Santa Fe R.R. continues to add to its large outstanding list but it is reported that purchases will not commence for approximately a month. The Gary Tube Co., Gary, Ind., is reported to have made some purchases at Pittsburg through the parent company, the National Tube Co. Some business is being placed by local steel companies and additional purchases are expected. Pending railroad lists include an angle bender, angle shear, upright drill and a couple of motor-driven grinders for the Elgin, Joliet & Eastern Ry. The public schools of La Crosse, Wis., has made inquiry for about fifteen items for metal working and ten for woodworking but is expected to place the business at Milwaukee.

Cleveland

April has brought a turn for the better in the machinery and metal working equipment industry in the Cleveland district, but though there is improvement in inquiry, to state that business is good is making too strong a statement. Leaders in all branches of the trade concur, in the last fortnight, that there has been a marked increase in the number of inquiries for all manner of equipment, from all manner of consumers, and are equally agreed that these inquiries are slow in turning into orders.

Some interest has been shown in automatic equipment. One maker has had a number of inquiries, accompanied by blue prints, from many sections of the country, although significantly few of these are from the manufacturing district in and about Cleveland.

It would appear that the general manufacturing trade will be buying equipment for replacement, but not for expansion.

Another encouraging feature is the increase in inquiries, and some orders also, from Canada. A number of planer orders have been received from these sources. While the export demand for any kind of machine tool equipment does not offer significant encouragement, lately there has been a considerable inquiry from Austria.

Cincinnati

Machine tool plants in Cincinnati are operating on a fairly good production basis, although business has not opened up this spring to the extent that many of the manufacturers had hoped for. Signs at the beginning of the year pointed to one of the most active production periods in several years, but several of the large plants report that conditions have not been as good as they had anticipated. Volume of business for the first three months of 1924 is running about on a par with the corresponding period last year, although some of the plants state that they are somewhat behind last year's record.

The business placed by automobile manufacturers has fallen off in the past month. This industry has been buying machine tools in smaller quantities than had been anticipated. Railroads have been making inquiries about machine tools and are expected to place considerable business locally within the next few months.

Lathes and milling machines are being turned out at a fair rate at present. Sales resistance is not quite as marked as it was a few months ago, but buyers are demanding immediate delivery. Planer manufacturers report that their plants are busy filling orders that have come in during the past few weeks. The electrical tool market is in good shape with manufacturers stating that their production is holding up to a satisfactory figure. The market for upright and radial drills is somewhat spotty, but is more stable than it was a month ago. There has been practically no change in the conveying machinery market where production is going along on a capacity basis with orders booked months ahead. Woodworking machinery houses are operating at capacity with no indication that there will be a let down in the future.

New York

Business in the New York district shows signs of revival and according to dealers revival is extremely welcome at this particular time. During the past week things took a turn for the better after a month of slowly declining trading with inquiries and sales both lifeless. Dealers reported that sales had been made to several railroads, among them the Pennsylvania and the New York Central, automobile and automobile parts makers, and to general industrials.

One of the outstanding achievements during the past ten days was the sale of a ship load of machine tools, mostly lathes, for export. Other good sized foreign orders were also recorded. Exporters report that Japanese buying has not yet commenced except for small tools and a few very badly needed machine tools. Indications are for sales in this quarter during the next month, however.

Used tools are finding a ready market with the inquiries running mostly to the heavier classifications.

Detroit

A more optimistic view of business conditions is prevailing in the machine tool field in Detroit as producers and distributors report an increase in inquiries for new machinery and tools and in actual orders placed.

Many of the smaller manufacturing plants seeing the trend of the times are showing an eagerness to improve capacities by installing better machinery. Larger plants are formulating plans, but are rather reticent just

at this time in announcing them, each seeming anxious to await the coming of better weather.

Conservative production programs and intensive sales campaigns are the order of the day in the automobile industry. The majority of manufacturers are continuing to limit their output to immediate dealer requirements. This condition will be bettered soon, it is firmly believed.

Production figures for automobiles during the first quarter of the year are the greatest in the industry's history, according to every indication. Stiffer competition during the next few months may result in large orders for new equipment as executives seek to cut production costs.

Most of the machine tool dealers are of the opinion that April sales will show a greater volume of business than during any of the preceding months of 1924.

Philadelphia

Although the general tone of business throughout the industrial centers of Philadelphia indicates a sound condition, the machine tool business remains in a state of uncertainty. Some of the leading manufacturers report the receipt of some inquiries, but the volume has not been sufficient to warrant the belief of an early resumption of substantial buying.

Manufacturers believe that eventually the business will again rest upon a more solid foundation, but how soon it is impossible to tell at this time. There are no extensive placing of orders, and although the railroads are somewhat active in locomotive and car building, there is nothing to indicate they soon will resume substantial buying of machine tools.

The best the manufacturers can predict at this time is that the outlook is "fair." The smaller manufacturers find a similar situation. Producers of woodworking machinery have enjoyed a fair volume of business, most of which comes from the territory immediately surrounding Philadelphia where there are located many factories.

Manufacturers of calculating machines have enjoyed a fair volume of business, with the greatest call for bookkeeping machinery.

The State Employment Bureau reported an increase in the demand for industrial labor. Representatives from other cities have been in Philadelphia recruiting workers.

Marlin-Rockwell Corp. Holds Election

The following have been elected to the new board of directors of Marlin-Rockwell Corp.: Henry K. Smith, Alfred C. Davis, F. W. Gurney, Arthur W. Kettle, Charles M. Nichols, E. Snell Hall, A. F. Rockwell, F. J. Galloway, Walter Robbins, Edgar Park, L. E. Stoddard and T. L. Chadbourne. The following new officers were elected: F. W. Gurney, chairman; Henry K. Smith, president; Alfred C. Davis, vice-president and general manager, J. H. Walters, treasurer; Ralph A. Gamble, secretary.

Personals

J. MARBOTTE of F. Auberty & Cie., Paris, France, sailed yesterday on the Chicago after a year in the United States spent in visiting machine tool shops and other manufacturing plants.

FRANK B. GILBRETH, president of Frank B. Gilbreth, Inc., has been made a member of the Masaryk Academy of Labor, one of the highest honors that can be bestowed by the Czecho-Slovak Republic.

E. L. ESSLEY of the E. L. Essley Machinery Co., Chicago, has returned from a short stay in Florida.

WILLIAM R. REID, general manager of the Torrington Co., Torrington, Conn., has been elected president, succeeding John F. Alvord, deceased.

J. ARTHUR DEAKIN will be the New York representative for the Universal Milling Machine Co., Hudson, Mass. His headquarters are at 150 Nassau St.

ARTHUR W. FOX has been elected vice-president and general manager of the Billing & Spencer Co., Hartford, Conn. He will continue in an advisory capacity with the Johns-Pratt Co., Hartford, Conn., of which he has been vice-president and general manager.

ALEXANDER MACDONALD has been appointed sales agent in Connecticut for J. L. Lucas & Son., Bridgeport, Conn. He formerly covered this territory for the Reed-Prentice Co., Worcester, Mass.

H. M. MERWIN, formerly assistant mechanical engineer of the National Advisory Committee for Aeronautics, Langley Field, Va., has joined the Western Electric Co. organization at the Hawthorne Works as a machine designer in the development branch.

C. H. REYNOLDS, who has been affiliated with the E. H. Welker Co., Inc., Detroit, representative of eight tool and supply manufacturers, has been elected secretary of the company and has also been named district manager for the Le Moyne Steel Co.

FRED O. HEUSER and H. F. LENK have organized the Heuser Manufacturing Co., 229 W. Illinois St., Chicago.

HOWARD A. ROGERS, formerly with the New Jersey Machine Corp., has recently been appointed Western representative of the Burt Machine Co., Baltimore, Md.

L. G. RANDALL has been appointed chief draftsman of the Mills Novelty Co. Chicago.

CLIFTON REEVES, formerly with the Willys-Overland Co., Toledo, Ohio, has opened offices at 149 Broadway, New York City, as an industrial engineer. A Detroit office will be maintained in the General Motors Building.

DAVID MAXWELL, formerly district manager of the Williams Tool Corp., in the Cleveland district has been transferred to the Chicago branch succeeding BLAKE D. HAY who has resigned.

H. H. VALIQUET, for the past eighteen years chief engineer of the B. F. Sturtevant Co., Chicago division, will join the organization of the Kirk & Blum Manufacturing Co., Cincinnati, Ohio, as chief engineer.

C. E. SKINNER, assistant director of engineering of the Westinghouse Electric & Manufacturing Co., was a recent visitor to Denver, Col., and while there, addressed engineers and manufacturers on: "The Need of Simplification and Standardization in Industry."

Business Items

The Reading Machine & Tool Co., Reading, Pa., has moved from 437 Washington St. to 560 N. Eleventh St.

The Cleveland office of William K. Stamets, Pittsburgh, has been moved from 974 to 774 and 776 Rockefeller Building.

A new price list has been issued by the Hisey-Wolf Machine Co., Cincinnati, Ohio, in which reductions are shown on many of its products.

An explosion and fire occurred at the plant of the Crocker-Wheeler Co. Ampere, N. J. The damage was not great.

The Cadillac Machinery Co., Detroit, Mich., has been appointed the eastern Michigan representative for the Sommers & Adams Co., Cleveland, Ohio.

The National Twist Drill Co. has moved its Chicago office from the Sharpless Building to 26 S. Jefferson St.

The Dale Machinery Co., Chicago, has been appointed exclusive representative in the Chicago territory for the Western Machine Tool Co., Holland, Mich.

The E. L. Essley Machinery Co., Chicago, Ill., has been appointed exclusive representative in Chicago for the Wilmarth & Morman Co., Grand Rapids, Mich.

The property of the Fulton Vise & Machine Co., Lowville, N. Y., will be sold at auction April 18.

The U. S. Ball Bearing Manufacturing Co., 4527 to 4567 Palmer St., Chicago, has changed its name to the Strom Ball Bearing Manufacturing Co. There has been no change in the personnel or policy of the company.

According to word received from Craig, Col., the American Iron & Machinery Co. of Oklahoma, has secured a site there and will build a supply station and factory. The firm is the maker of oil drilling machinery.

Obituaries

J. LEONARD MOORE, inventor of the Moore turbine, was found dead in bed at his home in Wellsville, N. Y. recently.

GEORGE M. CLARK, 82 years old, 1217 Forest Ave., Evanston, Ill., chairman of the board of directors of the American Stove Co., died April 6, at the Evanston Hospital.

MICHAEL E. DUGGIN, widely known in the metal working trades died recently in St. Catherine's Hospital, Kenosha, Wis. He had been a contributor to the *American Machinist* since 1910.

Leipzig Fair Proves Most Successful

More exhibitors than usual and many more buyers than were expected—Independence of design noted—Large number of new machine tools exhibited and demonstrated

By Our Berlin Correspondent

THE Leipzig Spring Fair which incorporates an exhibition of the German industries, most prominent of which is the machine tool exhibition, has this year afforded its patrons a pleasant surprise. Not one exhibitor seems to have gone to the Fair with the hope of getting adequate returns for his outlay. It was believed that the Fair could be nothing but a reflection of the general business depression. The usual number of visitors coming for instruction rather than for business could be counted upon, but expectations were running low with regard to the attendance of buyers. Foreign buyers were not expected at all.

It came as a surprise that the number of visitors during the first day had surpassed all records and that they stayed longer than in previous years and that they had come with the intention to buy and actually did buy. The volume of business transacted at the machine tool exhibition was not very large, but everyone seemed satisfied. Labels attached to tools bearing the inscription "sold" were by no means infrequent. People could be seen calling at exhibits with specifications of requirements in their hands. The explanation is that buyers are now getting into the habit of holding purchases in abeyance towards the Fair, the latter providing every convenience for a complete survey and comparison of prices.

Selling at the Fair

If this is so, the Machinery Fair is indeed developing into a marketing institution such as its originators had in mind. During the first years after its inauguration it was rather an advertising scheme and exhibitors seemed to be content to take home inquiries instead of orders. The lesson which this year's Leipzig Machinery Fair has taught is that machinery can be sold at such functions just like any other commodity if buyers get into the habit of regarding it as a marketing place. Opportunities which such Fairs afford for the user to talk with the maker is in no other case as valuable as when purchasing machinery.

The most prominent feature of the multitudes of products exhibited at the Leipzig Fair is the fact that German manufacturers are not following the lead of foreign competitors as readily and completely as they formerly did. It may be that this is due to the long span of time during which German emissaries of trade were debarred from penetrating the markets of the world as they used to do in pre-war times and, that the intimate contacts with the outside world is lacking. It may, however, be the case that a certain spirit of independence has already developed out of the comparative isolation of the last decade.

German products are now evidencing a much stronger note of individuality than they did in pre-war times. This is quite noticeable at the Machine Tool Fair. The tendency, so predominant in previous years, to adopt and thereafter adapt American designs, seems to have died out. Designers are now going their own way, closely watching what the "other fellow" is doing, but apparently free from the slavery in which they used to be held by successful ideas of others. It could, however, be seen that the novelty fever has abated and given place to a steadier spirit of progress. Novel features that bore the hall mark of a "talking point" rather than of practical value could hardly be seen.

Improving Designs

The chief energy seemed to have been devoted to perfecting existing designs and the attention of designers was apparently concentrated on the drive. The variable speed motor in close combination with the tool itself sems to dwell in their minds as the standard feature of the future. The all-geared drive appears to be considered not quite up-to-date and the cone-driven tool is almost obsolete. The vangard of designers has even moved a little distance ahead to the virgin ground of the hydraulic or oil drive. The Magdeburger Werkzeugmaschinenfabrik came out with such a drive at last year's Fair, fitted to one of their lathes. This year there were three more makes to be seen, not mentioning a fourth one which is wrapped in close mystery, without a hint given as to its nature. On the other hand the mystery surrounding the Magdeburger drive is now lifted. This drive like two others is built on the Foettinger principle of hydraulic transmission with a primary element or impeller and a secondary element or propeller. In the case of the drive mentioned these two elements are designed as rotary piston pumps. A number of cylinders are placed radially in the rotating cylinder block. The pistons carry rollers, which glide on a stationary eccentric cam at their ends and, by adjusting the eccentricity of this cam, the stroke of the pistons, and consequently the effect of the pump, can be regulated. The latter in its turn regulates the speed of rotation.

Oil inlets to the suction chambers of the pistons are provided by radial openings in the trunnion round which the cylinder block rotates. This trunnion has four holes acting as suction or pressure canals respectively. The inner surface of the cylinder block, by gliding over those inlets alternately opens or closes them. The driving pump is an exact duplicate of the driven pump. This oil gear can be made for uniform torque or for uniform power. The reverse is effected by a tumbler gear. For this oil gear the same efficiency is claimed as is obtained from a high class toothed gear.

In the "Sturm" gear manufactured by the Roller's Werk the principle is identical with the one described above. The pumps are centrifugal pumps with adjustable blades, the adjustment controlled by spring action. If the speed of the driven shaft decreases, its torque increases in proportion. The product of torque and revolutions remains uniform. It is claimed for a lathe equipped with this gear that, taking equal feed and cutting depth the power consumption is smaller than with an oil-geared or cone-driven lathe. The efficiency is said to be considerably higher. When roughing back gearing is employed. For a finishing cut the spindle is coupled to the driving shaft without gears.

A third gear is the "Enor" drive manufactured by the Turner works. This drive also employs rotating pumps. The variation of speed is produced by eccentricity adjusting the casing to the body of the pump thus forcing the oil to enter into the pump at a higher or lower speed. Rotation, reverse and stop is controlled by a small hand wheel, conveniently situated. This drive could be seen built into an ordinary milling machine with the cone taken out and the driving mechanism put in its place. The impeller pump driven by an electric motor is placed separately and intended to drive a group of tools. The efficiency of power transmission is said to be 80 per cent.

Mysterious Mechanism

Nothing can be said about the Popella variable speed driving mechanism. Deepest mystery is preserved regarding it. It employs no fluids and no gears. The mechanism is enclosed in a small cylindrical casing. By shifting a lever a wide range of gearless speeds can be obtained.

The oil drive shown by the Diskus Works on a horizontal grinding machine is of a different type. It is designed for the drive of the platen and simply consists of an oil driven double action piston pump, the stroke of which corresponds with the traverse of the platen. The latter is directly connected with the piston rod. The speed of the piston is varied by a valve regulating the oil inlet. The valve is controlled automatically and by hand.

Of the number of machine tools exhibited, the majority showed nothing essentially new, which could not be seen at last year's Fair. Quite besieged by spectators was Hahn & Kolb's exhibit of their line of automatic turret lathes and screw machines. These have several new features and are chiefly remarkable for their working speed and efficiency.

Their automatic screw machines, developed from the Brown & Sharpe design, but now bearing a strong individual note are doubtless keeping the front rank in their class among German makes. One of these automatics could be seen making brass screws about ¼-in. in diameter and ⅜-in. in length at the rate of 40 per minute. This tool has several noteworthy features. All rotating parts run in ball bearings.

Other Excellent Exhibits

Böhringer's are showing several handsome tools, two lathes, a large turret lathe and a planer. Their design of lathes with variable speed motor, encased in the headstock was this year shown in a lathe of 460 mm. swing. A similar design was seen at Pittler's exhibit on a turret lathe. At Loewe's show a horizontal milling machine was driven by a variable speed motor with intermittent feed, an automatic quick traverse and stop acting in all directions. This tool is specially designed for milling intermittent surfaces. The table traverses over gaps in the work at increased speed. Another new type is a key seat milling machine with variable speed motor. Krause & Co. showed a new type of planer, motor-driven. The motor is not mounted rigidly but has some play, allowing gravity to act as a belt tightening agency. The gearing is completely encased and running in oil. A unique tool at this exhibit was a combination lathe, shaping, milling and drilling machine with several attachments making it truly a one-piece work shop. The shaping, milling and drilling machine is placed in an extension of the bed beyond the head stock. The ram is situated below the latter. The cutting arbor is an extension of the lathe spindle. This machine is built for small repair shops especially in motor garages and ships. Shuchardt & Schuette showed a few new additions to their wide range of measuring instruments, which this firm is building in conjunction with Zeiss and independently. Among them may be mentioned a simple device for deciding the co-efficient of elongation at various temperatures and a gage for measuring shrinkage after heat treatment. At Richard Weber & Co.'s show could be seen a fixture for vertical milling machines for milling convex or concave cylindrical faces, especially designed for die sinking. The Wanderer Works showed a lathe type thread milling machine, with a device for separating the chips from the oil. An endless perforated band is placed between the V's of the bed that conveys the chips to a receptacle at the tail stock end.

The Naxos Union Works showed a horizontal grinding machine with segment grinding head of 8½ ft. by 3½ ft. table, a tool noteworthy for its size. The Raboma-Works had on exhibit a number of radial drills, their specialty, remarkable for the orthodox way in which centralization of control is carried out. A wheel turning lathe for locomotive and railway car shops made by Hegenscheidt deserved attention. The setting of a pair of large locomotive wheels is performed in 5 minutes. The makers claim for the machine, that the machining of tires is performed in less than one-half of the time required by competitive makes. New tires on wheels of 1,000 mm. diameter as are chiefly employed by the German State Railroads are machined in 19 minutes. Rocker arms control the mechanism of the four tool rests, two of which are forming rests and two back rests for machining the side faces. The two roller shaped forming tools in each rest are guided by templates. The tool holders are pivoted.

The Magdeburger Werkzeugmaschinenfabrik, already mentioned, in connection with the oil gear of this firm were showing as a novelty a bevel gear planer for which they claim that it is the only one in existence planing theoretically correct spiral bevel gears. The two tools cut simultaneously the two sides of the teeth. The tools are given for the reverse stroke a rather strong lift off their bore, which might be a source of inaccuracy. The teeth are tapering towards the small side of the gear. The machine works without dividing mechanism on the generating principle. The Samson Works exhibited a vertical grinder with revolving table for grinding circular pieces like chucks, saw blades, piston rings, etc. For small parts it is fitted with a magnetic chuck. At Alfred H. Schuette's extensive exhibit could be seen a four spindle automatic built, to be worked as a semi-automatic for chucked work. They also showed a milling cutter with nicked teeth and spiral fluted, for which a great saving of cutting power is claimed. The nicks are set off slightly. The teeth of this cutter are cutting with their flanks like so many individual lathe tools. The tool pressure on the work is thus greatly relieved. A large and massive shear could be seen, made by Pels & Co., the first equipped with variable speed motor. Three push buttons control the cutting stroke, the stop and the reverse. The shear can be stopped and reversed at any given point. It has automatic quick reverse. The variable speed motor in these machines, like those in many others, are made by the A. E. G. Electric Co., which firm is giving the problem of the electric drive of machine tools its most careful and energetic support.

The number of machine tool exhibitors was larger this year than in any previous year. A growing number of firms had to take space in detached locations. The number of machine tools shown at the Fair may be estimated at from 1,500 to 2,000, a fair percentage of which could be viewed in operation.

Churchill & Co. Changes

Referring to Charles Churchill & Co., Ltd., London, E. C., Arthur Chamberlain has been elected chairman of the board, J. L. Bishop has joined the board, and J. B. S. Gabriel and H. E. Churchill are now joint managing directors. D. M. Caird has been appointed manager of the Manchester branch, and K. Macphail manager of the Glasgow branch.

Arthur Chamberlain has been elected chairman of the board of the Churchill Machine Tool Co., Ltd., Broadheath, near Manchester, and the four new members of the board are H. E. Churchill, J. B. S. Gabriel, H. H. Asbridge, who is now works manager and chief engineer, and G. S. Maginness, who has also been appointed general manager.

S. H. March has no longer any active interest in the Churchill Machine Tool Co., Ltd., and Charles Churchill & Co., Ltd., and is resigning his position as director of the former. He has been associated with Charles Churchill & Co., Ltd., for some 27 years, and with the Churchill Machine Tool Co., Ltd., precision grinding machinery, as manager at its inception 18 years ago and later as director and general manager of the company.

Germans Buy American Motor Cars

The Moon Motor Car Co. has received an order for the immediate shipment of forty-two cars to Germany. In connection with the order, Anton Burnell, the company's distributor at Cologne, cabled: "This foreign business presages the improved economic conditions in Germany and resumption of buying of American-made automobiles. Sales of several hundred cars are expected this year."

Forthcoming Meetings

National Metal Trades Association. Twenty-sixth annual convention. Hotel Astor, New York City, April 23 and 24. L. W. Fischer, National Secretary, Peoples Gas Building, Chicago, Ill.

American Gear Manufacturers Association. Spring Meeting. April 28, 29 and 30, 1924. Lafayette Hotel, Buffalo, N. Y. T. W. Owen, secretary, 2443 Prospect Ave., Cleveland, Ohio.

Society of Industrial Engineers. Eleventh annual convention. Buffalo, N. Y. April 30, May 1 and 2. Headquarters, 608 S. Dearborn St., Chicago, George C. Dent, executive secretary.

American Society of Mechanical Engineers. Spring meeting. Cleveland, Ohio. May 26, 27, 28 and 29. Calvin W. Rice, secretary, 29 W. 39th St., New York City.

Southern Supply & Machinery Dealers Association, National Supply & Machinery Dealers Association, and American Supply & Machinery Manufacturers Association. Triple convention, May 19, 20 and 21, 1924, Hotel Cleveland, Cleveland, Ohio. F. D. Mitchell, secretary-treasurer, 1819 Broadway, New York City.

National Association of Purchasing Agents. Annual Convention, Mechanics Hall, Boston, May 20, 21, 22 and 23. W. L. Chandler, secretary, 19 Park Place, New York City.

Foreign Trade Council. Eleventh annual convention at Boston, June 4, 5 and 6. O. K. Davis, India House, Hanover Square, New York City, secretary.

The General Committee of Division V, Mechanical of the American Railway Association. Convention and exhibits. Atlantic City, June 11-18, 1924. V. R. Hawthorne, secretary, 431 S. Dearborn St., Chicago, Ill.

Railway Supply Manufacturers Association. Exhibit. Atlantic City, June 11-18, 1924.

American Society for Testing Materials. Twenty-seventh annual meeting, Chalfonte-Haddon Hall, Atlantic City, N. J. Week of June 23. C. L. Warwick, secretary-treasurer 1315 Spruce St. Philadelphia, Pa.

American Society for Steel Treating. Sixth Convention, Boston, Mass., Sept. 22, 23, 24, 25 and 26. W. H. Eisenman, secretary, 4600 Prospect Ave., Cleveland, Ohio.

New and Enlarged Shops

Machine Tools Wanted

Ill., Chicago—Elgin, Joliet & Eastern R.R. 208 South La Salle St., C. H. Kenzel, Purch. Agt.—two motor driven 24 in. upright drills, one angle bender and one angle shear.

Mass., Boston—T. Noonan & Sons Co., 38 Portland St. (manufacturer of barbers' supplies)—10 in. turret lathe with tools and tapping chuck; upright drill; grinder; hacksaw.

Mass., Charleston (Boston P. O.)—G. O'Riordan, 5 Chelsea St.—lathes, planer, upright drills, shaper, grinder, air compressor, shafting, pulleys, belting, small tools, etc., for proposed machine shop at Brookline.

Mass., Lawrence—City, W. T. Rochefort, Mayor—equipment for proposed garage and machine shop, list later.

Mass., Worcester—Star Auto Radiator Repair Wks., 33 Derby St.—equipment for proposed repair shop.

N. H., Keene—G. E. Hill (machine shop)—one 24 in. x 8 ft. engine lathe, upright drill, also planer, 24 in. head.

N. Y., Boonville—F. Ziegler—complete machine tool equipment for garage and motor repair shop, also air compressor.

N. Y., Brooklyn—Union Machine Co., 719 6th Ave.—Universal miller and punch press.

N. Y., Hudson Falls—J. B. White Motor Co., Inc.—complete machine tool equipment for garage, to replace fire loss.

N. Y., New York—G. Danzis Co., Inc., 47 Ann St. (toolmakers)—No. 2 B. & S. surface grinder with magnetic chuck.

N. Y., New York—Model Specialty Co., 401 East 19th St., W. Gorr, Purch. Agt.—power press about 25 ton pressure and 3 in. stroke.

O., Columbus — Brightman Bros. Co., Mackinson Ave. (manufacturer of nuts, etc.), C. E. Brightman, Purch. Agt.—machinery, including boring machine and threader, to enlarge plant.

Pa., Pittsburgh—Carnegie Steel Co., Carnegie Bldg., L. A. Miller, Purch. Agt.—one 14, one 18, one 20, one 24 and one 28 in. lathe, two boring mills, bevel geared generator, turret lathe, slotter, shaper, post slotter, planer, keyway milling machine and hacksaw.

Pa., Pittsburgh—Pittsburgh Plate Glass Co., Frick Bldg.—two 20 in. lathes, 4 ft. radial drill and shaper.

Wis., Milwaukee—Special Mchy. & Mfg. Co., 1919 St. Paul Ave. (manufacturer of stampings, etc.), M. Janisch, Purch. Agt.—heavy duty backgeared punch press, weight 10,000 to 12,000 lb.

Wis., West Bend—W. Warnkey, Main St.—sheet metal working machinery for proposed $40,000 shop.

N. S., Oxford—Oxford Fdry. & Machine Co., Ltd., H. W. Wood, Dir.—extension lathe, 20 ft. centers, 48 in. over shears, 40 in. carriage; gap lathe, 20 and 48 in. gap, 32 in. over shears, 40 in carriage, 20 ft. centers; pipe and bolt threading machine to thread pipe 1 to 4 in. diameter and bolts ¼ to 1¼ in.; one crosscut and 7 ripsaws, tilting table to take up to 18 or 20 in. saws; hand crane, from face to face of truck wheels 18 ft. 3 in., length of crane not to exceed 19 ft. 2 in., height from tread of main trucks to top of carriage 2 ft. 3 in.

Ont., Beaverton — Smith Bros. — lathe, drill and emery wheel for repair shop.

Ont., Essex—McNeill & Walsh—complete equipment for plant for the manufacture of dies and tools, also for general repair work.

Ont., Huntsville—J. E. Mosley, Centre Garage—tool room lathe, drill press and air compressor.

Ont., Orilla—Standard Garage Co., 29 West M. St., A. J. Orr, Purch. Agt.—equipment for repair shop and service station.

Ont., Penetanguishene—B. Corbeau, Nelson St.—toolroom lathe for repair shop and garage.

Que., Montreal—E. Gobet, Ltd., 370 5th Ave.—complete equipment for new garage and repair shop.

Que., Montreal—H. Papas, 88 Fort St.—lathe, drill, chain hoist, etc., for new garage.

Machinery Wanted

Md., Baltimore—Schluderberg-Kurdle Co., Baltimore and 5th Sts., W. T. Schluderberg, Pres.—equipment for proposed $350,000 addition to packing plant.

Mass., Malden—School Com.—machinery, including wood lathes, planers, matchers, sanders, saws, tables, benches, small tools, shafting, pulleys, belting, etc., for manual training department of proposed $350,000 school.

Mass., Somerville—Davenport Brown Co. (woodworking)—matcher and joiner, also buzz planer.

Minn., Minneapolis—Bd. Educ., 305 City Hall, C. F. Womrath, Business Supt.—manual training and shop equipment for proposed $650,000 vocational school.

Minn., St. Paul—Great Northern R.R., 4th and Jackson Sts., F. A. Bushnell, Purch. Agt.—30 ton locomotive crane.

Mo., Poplar Bluff—T. L. Moore (marble)—40 to 65 ft. air compressor, belted type.

N. Y., Antwerp—Antwerp Box & Lumber Co., W. S. Brooks, Purch. Agt.—double surface planer.

N. Y., Canton—W. D. Gilson, Riverside Dr.—bench planer (new or used), also 16 to 20 in. vertical post drill with crankshaft.

N. Y., Canton—J. H. Wade Co., Riverside Dr.—laundry machinery and equipment.

N. Y., Gouverneur—J. M. Horton Co. (manufacturer of ice cream and dairy products), A. E. Boughner, Mgr.—from $50,000 to $60,000 worth of refrigerating, separating and pasteurizing equipment.

N. Y., Mount Morris—Greene Specialty Corp., Erie St., E. A. Greene, Purch. Agt.—special machinery and equipment for the manufacture of cutlery.

Pa., Williamsport—Stroehmann Bros. Co., 343 Washington Ave.—ovens, complete mixing machinery, etc.

Tenn., Bristol—Central Glass Co., Commonwealth Ave.—grinding, cutting, blowing and other machinery for the manufacture of glass mirrors.

Tenn., Chattanooga—Burdett Oxygen Co., 1270 Market St., W. P. Hendricks, Mgr.—equipment for proposed $40,000 factory at Knoxville, later.

Tenn., Jackson — J. C. Bruce — motor driven air compressor.

Wis., Manitowoc—Northern Wisconsin Produce Co., 6th and Quay Sts.—refrigeration machinery for proposed $40,000 cold storage plant.

Wis., North Milwaukee — Paramount Woodwork Co., S. C. Coddington, Purch. Agt.—woodworking machinery, including mortiser.

Wis., Richland Center—Richland Co-operative Creamery Co., J. H. Turgasen, Purch. Agt.—refrigeration machinery, several ton capacity, also separators, condensors, etc.

Wis., Sheboygan—Oshkosh Corrugated Box Co., c/o J. P. Verhulst, 1310 New York Ave.—special machinery, including cutter, creaser, etc.

Alta., Red Deer—Red Deer Sunburst Oils, Ltd., C. T. Cline, Purch. Agt.—complete oil drilling equipment.

N. S., Amherst—Nova Scotia Hard Wood Product Co., Ltd.—woodworking equipment for new plant.

Ont., Beaverton—Natl. Furnace & Fdry. Co.—equipment for proposed extension.

Ont., Bracebridge—W. C. Denniss, Kimberley Ave.—planing mill equipment.

Ont., Clifford—Clifford Butter Factory, H. Bieman, proprietor—complete equipment, to replace fire loss.

Ont., Leamington—Leamington Post, B. Lane, Pres.—high speed press, folding and special equipment for printing plant.

Ont., Midland—Midland Candy Wks., 199 King St., C. A. Diakos, Purch. Agt.—machinery for the manufacture of candy.

Ont., Midland—Midland Grain Elevator Co.—equipment for proposed $500,000 grain elevator.

Ont., Orillia—Blackburn Bros., 42 West S St.—air compressor, chain hoist and battery charger for garage.

Ont., Parry Sound—M. Rogers—bandsaws, conveying equipment, etc., for sawmill.

Ont., Rosseau—F. Bishton—bandsaws, cutoff saws and planer for sawmill.

Ont., Seaforth—Huron Flour Mills—equipment to increase capacity of mill.

Ont., Simcoe—Dominion Canners—canning equipment to increase capacity of plant at Port Burwell.

Ont., Toronto — Toronto Transportation Comn., Bd. of Trade Bldg.—transformers, motor generators, etc., for proposed $200,000 addition to Yonge St. substation.

Que., Rigaud—Charlesbois & Fils—battery charging equipment, acetylene gas tanks, compressor and bench lathe.

Metal Working Shops

Ark., Little Rock—The 555 Tire Service Co., 223 Bway., will soon receive bids for the construction of a 3 story, 140 x 150 ft. garage and automobile service building on Bway and 2nd St. Estimated cost $160,000. Wittenberg, Deloney & Watts, Southern Trust Bldg., Archts.

Calif., Lemore—The Lemore Union High School Dist. is having working plans prepared for the construction of a shop, etc. Estimated cost $150,000. W. H. Weeks, 369 Pine St., San Francisco, Archt.

Calif., Los Angeles—The P. S. Wright Co., 3981 West 6th St., plans to build an 8 story garage in Westlake section. Estimated cost $150,000.

Calif., Monrovia—The Colby Management Corp., Pacific Electric Bldg., Los Angeles, awarded the contract for the construction of a foundry, machine shops and assembling plant, 100 x 300 ft. each, here.

Calif., Oakland—The Fageol Motors Co., Hollywood and 107th Aves., awarded the contract for the construction of a 1 story factory. Estimated cost $42,000.

Calif., Oakland—W. J. Miller, Archt., 417 Market St., San Francisco, is receiving bids for the construction of a factory to consist of a group of six buildings on 80th Ave., here, for the Illinois Wire & Cable Co., Sycamore, Ill. Estimated cost first unit $40,000, complete plant $250,000. Noted Apr. 3.

Conn., Stratford (Branch of Bridgeport)—The Bridgeport Safety Emery Wheel Co., 82 Knowlton St., Bridgeport, plans to build a 1 and 2 story factory on West Broad St., here. Engineer or architect not selected.

Ky., Louisville—The Ford Motor Co., Highland Park (Detroit P. O.), Mich., awarded the contract for the construction of an assembly plant, here. Estimated cost $1,500,000. Noted Jan. 10.

Ky., Louisville—The Reo-Spalding-Kelley Co., 210 East Bway., plans to build a 2 story, 57 x 200 ft. garage and salesroom. Estimated cost $150,000, including equipment.

Ky., Louisville—Summers-Herrman, Inc., 905 3rd St., awarded the contract for the construction of a 3 story, 90 x 100 ft. garage and salesroom on 3rd and Breckinridge Sts. Estimated cost $150,000. Noted Mar. 6.

The Weekly Price Guide

Rise and Fall of the Market

Iron and Steel—Pig-iron stocks gradually diminishing; current shipments mostly on orders previously placed; production slowing down. Steel mill operations also slower. Unfilled steel tonnage (U. S. Steel Corp.) Mar. 31, 1924, was 4,782,807 tons, against 4,912,901, Feb. 29, and 7,403,332 tons on Mar. 31, 1923. Steel plates, $2.40@$2.50 per 100 lb., Pittsburgh; railroads taking bulk of plate tonnage. Structural market slow; minimum quotations, $2.40 per 100 lb. f.o.b. mill.

Non-ferrous Metals—Some improvement in lead demand. Tin market uncertain with quotations nominal; prices rose in London and declined in New York during week. Copper market weak; antimony also tending downward. Zinc prices, claimed to be below cost of production.

Miscellaneous—Lead and linseed oil firm at present levels; scarcity of latter reported.

(All prices as of Apr. 11.)

IRON AND STEEL

PIG IRON—Per gross ton—Quotations compiled by The Matthew Addy Co.:

CINCINNATI	
No. 2 Southern	$25.05
Northern Basic	24.00
Southern Ohio No. 2	24.00
NEW YORK—Tidewater Delivery	
Southern No. 2 (silicon 2.25@2.75)	28.00
BIRMINGHAM	
No. 2 Foundry	22.50@23.50
PHILADELPHIA	
Eastern Pa., No. 2x (silicon 2.25@2.75)	24.25
Virginia No. 2	28.17
Basic	24.00
Grey Forge	24.00
CHICAGO	
No. 2 Foundry local	24.50
No. 2 Foundry, Southern (silicon 2.25@2.75)	27.00
PITTSBURGH, including freight charge from Valley	
No. 2 Foundry	25.77
Basic	25.77
Bessemer	26.77

IRON MACHINERY CASTINGS—Cost in cents per lb. of 100 flywheels, 6-in. face x 24-in. dia., hub not cored, good quality gray iron, weight 275 lb.:

Detroit	4.50@4.75
Cleveland	4.75@5.00
Cincinnati	5.00@7.50
New York	5.00@5.50
Chicago	5.25@5.75

SHEETS—Quotations are in cents per pound in various cities from warehouse; also the mill base in large lots.

Blue Annealed	Pittsburgh	New York	Cleveland	Chicago
No. 10	$2.90@3.00	4.34	3.75	4.00
No. 12	3.00@3.10	4.39	3.80	4.05
No. 14	3.10@3.20	4.44	3.85	4.10
No. 16	3.30@3.40	4.54	3.95	4.20
Black				
Nos. 17 and 21	3.70	4.65	4.45	4.55
Nos. 22 and 24	3.75	4.70	4.50	4.55
Nos. 25 and 26	3.80	4.75	4.55	4.60
No. 28	3.85	4.85	4.65	4.70
Galvanized				
Nos. 10 and 11	3.90@4.00	4.90	4.70	4.60
Nos. 12 and 14	4.00@5.10	5.00	4.80	4.70
Nos. 17 and 21	4.30@4.40	5.30	5.10	5.00
Nos. 22 and 24	4.45@4.55	5.45	5.25	5.15
No. 26	4.60@4.70	5.55	5.50	5.30
No. 28	4.90@5.00	5.85	5.80	5.60

WROUGHT PIPE (Welded)—Warehouse discounts are as follows:

	New York Black	New York Galv.	Cleveland Black	Cleveland Galv.	Chicago Black	Chicago Galv.
1 to 3 in. steel butt welded	48%	34%	55½%	43½%	50%	37%
2½ to 6 in. steel lap welded	44%	30%	53½%	40½%	47%	34%

Malleable fittings: Classes B and C, banded, from New York stock sell at list plus 4%; class A, plus 23%. Cast iron, standard sizes, 34% off.

SEAMLESS STEEL TUBING—Following base discounts are on 20 gauge or .035-in., round, cold-drawn tubing, ½-in. to 1-in., O.D., weighing 0.17 lb. to 0.36 lb. per ft. Cutting charge per 100 cuts, $1.50 to $1.58:

O.D. Inches	List Price per ft.	Differential Discount	O.D. Inches	List Price per ft.	Differential Discount
½	$0.09	50%	⅞	$0.16	35%
⅝	.11	45%	1	.18	31%
¾	.14	40%			

NOTE—The discounts are to be lowered by the following differentials in the case of regular .10-.20 carbon: 25,000 ft. or over, 83; 15,000 to 25,000 ft., 82; 5,000 to 15,000 ft., 81; 1,000 to 5,000 ft., 80; less than 1,000 ft., 79.

MISCELLANEOUS—Warehouse prices in cents per pound in 100-lb. lots:

	New York	Cleveland	Chicago
Open hearth spring steel (base)	4.50	6.00	4.20
Spring steel (light) (base)	7.00	6.00	6.00
Coppered Bessemer rods (base)	6.53	8.00	6.70
Hoop steel	5.19	4.66	4.55
Cold rolled strip steel	7.50	8.25	7.40
Floor plates	5.80	5.66	5.80
Cold drawn shafting or screw	4.40	3.90	4.00
Cold drawn flats, squares	4.90	4.40	4.50
Structural shapes (base)	3.59	3.46	3.30
Soft steel bars (base)	3.49	3.36	3.20
Soft steel bar shapes (base)	3.49	3.36	3.20
Soft steel bands (base)	4.39	3.61	3.95
Tank plates (base)	3.59	3.46	3.30
Bar iron (3.10@3.15 at mill)	3.49	3.36	3.20
Tool steel	11.00	....	....
Drill rod (from list)	55@60%	40@55%	50%

Electric welding wire, New York, 3/32, 8.35c.; ⅛, 7.85c.; 5/32 to ¼, 7.35c. per lb.

METALS

Current Prices in Cents Per Pound

Copper, electrolytic (up to carlots), New York			14.00
Tin, 5-ton lots, New York			48.00
Lead (up to carlots), St. Louis	.8@8.12½	New York	8.87½
Zinc (up to carlots), St. Louis	6.20	New York	7.00

	New York	Cleveland	Chicago
Aluminum, 98 to 99% ingots, 1-15 ton lots	28@29	30.00	29.50
Antimony (Chinese), ton spot	10.50	12.75	13.25
Copper sheets, base	21.25	21.50	23.00
Copper wire, base	16.75	19.25	16.25
Copper bars, base	20.50	22.75	19.50
Copper tubing, base	22.75	27.50	23.00
Brass sheets, base	17.75	22.00	18.75
Brass tubing, base	21.50	27.00	20.50
Brass rods, base	15.50	18.00	15.75
Brass wire, base	18.25	22.00	....
Zinc sheets (casks)	10.75	11.00	....
Solder (½ and ½), (case lots)	39.00	37.50	31.50
Babbitt metal (83% tin)	60.00	63.00	52@56
Babbitt metal (35% tin)	28.00	20.00	25@28
Nickel (ingot and shot) f.o.b. refinery	27.00	....	....
Nickel (electrolytic) f.o.b. refinery	30.00	....	35.00
Nickel (F shot) f.o.b. refinery	30.00	....	....

SPECIAL NICKEL AND ALLOYS—Price in cents per lb., f.o.b Huntington, W. Va.:

Rolled nickel sheet (base)	52.00
Hot rolled rods, Grade "A" (base)	50.00
Cold drawn rods, Grade "A" (base)	58.00

Shop Materials and Supplies

METALS—Continued

Manganese nickel hot rolled rods "E"—low manganese (base) 54. 00
Manganese nickel hot rolled rods "D"—high manganese (base) 57. 00

Base price of monel metal in cents per lb., f.o.b. Huntington, W. Va.:

Shot	32. 00	Hot rolled rods (base)	40. 00
Blocks	32. 00	Cold drawn rods (base)	48. 00
Ingots	38. 00	Hot rolled sheets (base)	42. 00

OLD METALS—Dealers' purchasing prices in cents per pound:

	New York	Cleveland	Chicago
Copper, heavy, and crucible	10.50@11. 00	11.50	11. 25
Copper, heavy, and wire	10.00@10. 75	11. 00	10. 50
Copper, light, and bottoms	8.00@9.75	10. 00	9. 50
Lead, heavy	7. 12½@7. 75	7. 00	7. 50
Lead, tea	4.00@6. 50	4. 50	6. 50
Brass, heavy, yellow	5. 37½@7. 00		6. 75
Brass, heavy, red	7. 62½@9. 25	10. 00	9. 00
Brass, light	4. 62½@6. 00	6. 00	6. 25
No. 1 yellow brass turnings	5. 12½@7. 00	6. 50	6. 75
Zinc	3. 62½@4. 00	3. 50	3. 75

TIN PLATES—American Charcoal—Bright—Per box.

		New York	Cleveland	Chicago
"AAA" Grade:				
IC,	20x28, 112 sheets	$24. 30	$22. 85	$18. 50
"A" Grade:				
IC,	20x28, 112 sheets	20. 20	18. 00	17. 00
	Coke Plates—Primes, 20x28 in.			
100-lb.,	112 sheets	14. 00	13. 00	14. 50
	Terne Plates—Small lots, 8-lb. Coating			
IC,	14x20	8. 25	6. 55	7. 40

MISCELLANEOUS

	New York	Cleveland	Chicago
Cotton waste, white, per lb.	$0. 14@0. 21	$0. 20	$0. 14
Cotton waste, colored, per lb.	. 09@ .12½	.17	. 10½
Wiping cloths, 13¼x13¾, per lb	11. 75	36. 00 per M	. 16
Wiping cloths, 13¼x20½, per lb.	....	52. 00 per M	. 16
Sal soda, per 100 lb.	2. 40	2. 25	2. 65
Roll sulphur, per 100 lb.	3. 60	3. 50	3. 50
Linseed oil, per gal., 5 bbl. lots	. 95	1. 08	. 94
Lard cutting oil, 25% lard, per gal.	. 55	. 50	. 79*
Machine lubricant, medium-bodied (50 gal. wooden bbl.), per gal.	.29	. 35	. 40
Belting—Present discounts from list in fair quantities (½ doz. rolls).			
Leather—List price, 2c. per sq.in., per ply:			
Medium grade	40–2½%	30–10%	30–10%
Heavy grade	30–5%	30%	20–5–2½%
Rubber and duck:			
First grade	50%	50–10%	40–10%
Second grade	50–5%	60–5%	60–5%
Abrasive materials—In sheets 9x11 in., No. 1 grade, per ream of 480 sheets:			
Flint paper	$5. 40	$5. 84	$6. 48
Emery paper	9. 90	11. 00	8. 80
Emery cloth	31. 12	31. 12	29. 48
Emery disks, 6 in. dia., No. 1 grade, per 100:			
Paper	1. 49	1. 24	1. 40
Cloth	3. 38	2. 67	3 20
Fire clay, per 100 lb. bag		. 65	. 60
Coke, prompt furnace, Connellsville	per net ton		3. 75@4. 00
Coke, prompt foundry, Connellsville	per net ton		4. 75@5. 50
White lead, dry or in oil	100 lb. kegs		New York, 15. 00
Red lead, dry	100 lb. kegs		New York, 15. 00
Red lead, in oil	100 lb. kegs		New York, 16. 50

*Chicago quotes on pure lard oil, No. 1 grade.

Comparative Warehouse Prices

New York	Unit	Current Price	Four Weeks Ago	One Year Ago
Soft steel bars	per lb.	$0.0349	$0.0354	$0.0334
Cold finished shafting	per lb.	0.044	0.044	0.042
Brass rods	per lb	0.16	0.16	0.20
Solder (½ and ½)	per lb.	0.39	0.39	0.34
Cotton waste	per lb.	.14@.21	.14@.21	.10@.13
Washers, cast iron (⅛ in.)	per 100 lb.	6.50	6.50	6.50
Emery, disks, cloth, No. 1, 6 in. dia.	per 100	3.38	3.38	3.02
Lard cutting oil	per gal.	0.55	0.58	0.55
Machine oil	per gal.	0.29	0.29	0.297
Belting, leather, medium	off list	40–2½%	40–2½%	30–10%
Machine bolts up to 1x30 in.	off list	45%	45%	30%

SHOP SUPPLIES

Current Discounts from Standard Lists

	New York	Cleveland	Chicago
Machine Bolts:			
All sizes up to 1x30 in.	45%	60%	55–5%
1½ and 1¼x3 in. up to 12 in	15%	50–5%	50%
With cold punched hex. nuts up to 1 in. diam. (plus std. extra of 10%)	30%	$3. 50 net	....
With hot pressed hex. nuts up to 1x30 in. (plus std. extra of 10%)	35%	3. 50 net	$4. 00 off
Button head bolts, with hex. nuts	List net	List net	3. 50
Hex. head and hex. nut bolts	List net	.....List plus 10%	
Lag screws, coach screws	45%	.....	50-5%
Square and hex. head cap screws	75%	75%	75–5%
Carriage bolts, up to 1 in.x30 in.	35%	05%	50–5%
Bolt ends, with hot pressed nuts	45%	.....	55-5%
Tap bolts, hex. head, list plus	35%	.....	.....
Semi-finished nuts, ⅜ and smaller	65%	.....	.....
Semi-finished nuts, ½ and larger	60%	70%	80%
Case-hardened nuts	50%	.....	.....
Washers, cast iron, ½ in., per 100 lb. (net)	$6. 50	$4. 00	$4. 00
Washers, cast iron, ⅜ in., per 100 lb. (net)	5. 50	4. 00	4. 00
Washers, round plate, per 100 lb. Off list	1. 50	4. 00	4. 00
Nuts, hot pressed, sq., per 100 lb. Off list	1. 00	3. 50	3. 50
Nuts, hot pressed, hex., per 100 lb. Off list	1. 00	3. 50	3. 50
Nuts, cold punched, sq., per 100 lb. Off list	1. 00	3. 50	3. 50
Nuts, cold punched, hex., per 100 lb. Off list	1. 00	3. 50	3. 50
Rivets:			
Rivets, 7/16 in. dia. and smaller	50%	60%	60%
Rivets, tinned	50%	60%	4½c. net
Button heads ¾-in., ⅞-in., 1x2 in. to 5 in., per 100 lb. (net)	$5. 00	$3.60	$3. 75
Cone heads, ditto (net)	5. 20	3.80	3. 95
1¼ to 2-in. long, all diameters, *EXTRA* per 100 lb.	0. 25	.....	0. 15
⅜ in. diameter *EXTRA*	0. 35	.....	0. 15
½ in. diameter *EXTRA*	0. 75	.....	0. 50
1 in. long, and shorter *EXTRA*	0. 75	.....	0. 50
Longer than 5 in. *EXTRA*	0. 50	.....	0. 25
Less than 200 lb. *EXTRA*	0. 50	.....	0. 50
Countersunk heads *EXTRA*	0. 45	.....	$4.20 base

Mass., Boston—J. R. Worcester Co., Archts., 79 Milk St., receiving bids for the construction of a 5 story, 66 x 80 ft. Substation 72, including machine room, for the Edison Electric Illuminating Co., 70 State St.

Mass., Brookline (Branch of Boston)—G. O'Riordan, 5 Chelsea St., Charlestown (Boston P. O.), is having plans prepared for the construction of a 1 story, 185 x 250 ft. machine shop and garage at 161 Harvard St., here. H. F. Bryant, 234 Washington St., Archt.

Mass., Lynn—The Genl. Electric Co. awarded the contract for the construction of a 1 story, 60 x 280 ft. galvanizing building.

Mass., Peabody—The Dawson Bleachery is having plans prepared for the construction of a 2 story, 50 x 150 ft. machine shop. Estimated cost $75,000. Smith & Walker, 80 Boylston St., Boston, Archts.

Mass., Springfield—The Smith Carriage Co., 2 Park St., awarded the contract for the construction of a 4 story, 100 x 160 ft. factory. Estimated cost $100,000.

Mass., Worcester—H. L. Meacham, Archt., 571 Main St., is receiving bids for the construction of a 2 story, 60 x 120 ft. repair factory for the Star Auto Radiator Repair Wks., 33 Derby St.

Mich., Detroit—The Capitol Brass Co., 2306 Franklin St., is having plans prepared for the construction of a 1 story, 85 x 420 ft. factory for the manufacture of brass products, on West Jefferson Ave. Lane, Davenport & Peterson, Charlevoix Bldg., Archts.

Mich., Detroit — Smith, Hinchman & Grylls, Archts., 800 Marquette Bldg., are receiving bids and will open same about Apr. 21 for the construction of a 1 story, 100 x 140 ft. factory in the West End for the Kelsey Wheel Co., 3600 Military St. Estimated cost $50,000.

Mich., River Rouge—The Ford Motor Co., Highland Park (Detroit P. O.), is having plans prepared for the construction of a 1 story, 544 x 1,320 ft. steel mill, here. A. Kahn, 1000 Marquette Bldg., Detroit, Archt.

Mo., North Kansas City—The Amer. Can Co. plans to build a 4 story, 113 x 595 ft. factory on 14th St. Engineer or architect not selected.

Mo., St. Louis—P. Brockman, Pres. Police Bd., 112 South 12th Blvd., is receiving bids and will open same about Apr. 21 for the construction of a 2 story, 143 x 150 ft. garage on Laclede Ave. Estimated cost $150,000. H. G. Clymer, Wainwright Bldg., Archt. Noted July 19.

Mo., St. Louis—The Lambert-Graves Motor Co., 4576 Manchester Ave., awarded the contract for the construction of a 2 story, 75 x 125 ft. automobile salesroom and garage on Lindell Blvd. Estimated cost $160,000.

Mo., St. Louis—The Mechanics Iron Wks., 901 South Ewing Ave., is building a 1 and 2 story, 98 x 180 ft. foundry on Edmund St. Estimated cost $40,000.

Mo., St. Louis—G. Seeley, c/o Bottorff-Giles Co., 4914 Delmer Blvd., will soon receive bids for the construction of a 4 story, 100 x 152 ft. garage on Walnut and 11th Sts. Estimated cost $300,000. Private plans.

Mont., Livingston—The Northern Pacific Ry. Co., 5th and Jackson Sts., St. Paul, Minn., awarded the contract for the construction of a 1 story, 144 x 186 ft. boiler shops, here. Estimated cost $100,000.

N. Y., Baldwinsville—The Amer. Knife Co. plans additions and alteration to mill. Cost between $40,000 and $50,000. A. J. Tooley, Pres.

N. Y., Brooklyn—The Brooklyn Borough Gas Co., 2909 South 17th St., is having plans prepared for the construction of a 2 story, 200 x 200 ft. mechanical plant, including machine shop, on Coney Island Ave. Estimated cost $250,000. Bloch & Hesse, 18 East 41st St., New York, Archt.

N. Y., Brooklyn—The Commissioner of Plant & Structures, Municipal Bldg., New York, will receive bids until Apr. 21 for the construction of a housing station, including small repair shop, on 2nd Ave. and 11th St., here.

N. Y., Coney Island (Brooklyn P. O.)—The Transit Comn., 49 Lafayette St., New York, is having plans prepared for the construction of a repair shop at yards, here. Estimated cost $500,000. Private plans.

N. Y., Elmira—The International Harvester Co. of America, 656 State St., plans to build an addition to its plant. Estimated cost $100,000. S. S. Houston, Mgr.

N. Y., Hudson Falls—The J. B. White Motor Co., Inc., plans to build a garage. Estimated cost $150,000.

N. Y., New York—M. F. Westergreen, Inc., 213 East 144th St., manufacturer of sheet metal, will build a 2 story, 27 x 100 ft. plant on East 144th St. Estimated cost $200,000.

N. Y., Schenectady—The Amer. Locomotive Co., North Jay St., plans to build a pattern and carpenter shop. Estimated cost $350,000.

N. Y., Troy—The Troy Coke & Iron Corp., c/o J. A. Burden, Burden Iron Wks., is having plans prepared for the construction of a blast furnace and coking plant. Bids will be received about May 1. Estimated cost $3,000,000. W. W. Wright and L. Willard, Troy, Engrs.

O., Canton—The Canton Bridge Co. plans to build a 1 story addition to its factory for the manufacture of steel products, on Belden Ave. and 10th St. Estimated cost $40,000.

O., Cleveland—The S. Bingham Sons Co., 1515 Kentucky Ave., Indianapolis, Ind., manufacturer of printers rollers, is receiving bids for the construction of a 3 story, 107 x 113 ft. factory on Clinton and Dexter Aves., here. Estimated cost $100,000. H. Holmes, 720 North Michigan Ave., Chicago, Ill., Archt.

O., Cleveland—The Bowler Fdry Co., 1688 Columbus Rd., had plans prepared for the construction of a 1 story, 90 x 203 ft., 40 x 100 ft. and 100 x 146 ft. foundry on East 49th St. Estimated cost $250,000. J. H. Bruce, Pres. A. G. Simon, 716 Hippodrome Bldg., Archt. Noted Jan. 31.

O., Cleveland—The Cleveland Heater Co., 1900 West 112th St., is receiving bids for the construction of a 1 story, 100 x 250 ft. addition to its factory. Estimated cost $100,000. L. Friedman, Pres. G. S. Rider & Co., Century Bldg., Archts. Noted Jan. 31.

O., Cleveland—The Eagle Improvement Co., c/o H. D. Hughes, Archt., Citizens Bldg., awarded the contract for the construction of a 2 story, 100 x 115 ft. garage on Eagle Ave. Estimated cost $150,000. Noted Feb. 14.

O., Cleveland—The Ohio Machine & Boiler Co., 1503 University Rd., had plans prepared for the construction of a 1 story, 64 x 100 ft. addition to boiler shop. Estimated cost $40,000. E. F. Simon, Genl. Mgr. A. G. Simon, 716 Hippodrome Bldg., Archt.

O., Cleveland—D. Round & Son, Stop 3, A. B. C. Line, manufacturer of chains, had plans prepared for the construction of a 1 story, 120 x 210 ft. factory. Estimated cost $75,000. L. B. Round, Pres. H. W. Maurer, 1991 East 66th St., Archt.

O., Cleveland—The White Co., 842 East 79th St., manufacturer of automobiles, is having plans prepared for the construction of a 2 story, 150 x 160 ft. engineering building at 825 East 79th St. Estimated cost $200,000. W. C. White, Pres. Watson Co., 4614 Prospect Ave., Archts.

Okla., Oklahoma City—The Ford Motor Co., Highland Park (Detroit P. O.), Mich., is having plans prepared for the construction of a 1 story, 100 x 200 ft. addition to its automobile service station on Main and Francis Sts., here. A. Kahn, 1000 Marquette Bldg., Detroit, Archt.

Okla., Tulsa—The Oklahoma Natural Gas Co., 1 East 36th St., awarded the contract for the construction of a 2 story, 47 x 50 ft. machine shop and office, here. Estimated cost $15,000.

Pa., Phila.—The Phila. Rapid Transit Co., 8th and Dauphin Sts., awarded the contract for the construction of a 90 x 686 ft. inspection shop, garage, etc., on Johnston St. Estimated cost $200,000.

Pa., Phila.—J. W. Vandergrift, 1017 Cambria St., awarded the contract for the construction of a 1 story, 63 x 255 ft. garage and service station on Cambria and 12th St.

Pa., Pittsburgh—The Wolverine Mfg. Co., Page and Fontella Sts., awarded the contract for the construction of a 3 story, 80 x 160 ft. toy factory on Western Ave. Estimated cost $100,000.

Pa., Reading—The Carpenter Steel Co., River Rd. and Exeter St., is having plans prepared for the construction of a 1 story, 150 x 400 ft. factory. Estimated cost $200,000. F. H. Muhlenberg, Gaaster Bldg., Archt.

Pa., Sharon—The Westinghouse Electric & Mfg. Co., East Pittsburgh, awarded the contract for the construction of two 1 story shop buildings, 126 x 1,025 ft. and 92 x 664 ft., respectively, also 4 story, 90 x 355 ft. factory, etc., here. Noted Mar. 6.

R. I., Pawtucket—The Collyer Insulated Wire Co., 249 North Main St., awarded the contract for the construction of a 1 story, 60 x 120 ft. factory. Estimated cost $45,000.

Tenn., Knoxville—The Knoxville Ry. & Power Co. plans to build additions to shops, etc.

Tenn., Leewood (Memphis P. O.)—The Louisville & Nashville R.R., 10th and Bway., Louisville, Ky., is having plans prepared for the construction of a roundhouse and shops, here. Cost will exceed $40,000. W. H. Courtenay, Ch. Engr.

Tex., Dallas—The Ford Motor Co., Highland Park (Detroit P. O.), Mich., will soon award the contract for the construction of a 1 story, 301 x 830 ft. assembly plant, etc., on East Grand Ave., here. A. Kahn, 1000 Marquette Bldg., Detroit, Archt.

Tex., Fort Worth—W. F. George, 2316 5th Ave., is having plans prepared for the construction of a 2 story, 100 x 100 ft. garage on 1st and Taylor Sts. Estimated cost $150,000. W. G. Clarkson, 1st Natl. Bank Bldg., Archt.

Wash., Tacoma—The Chicago, Milwaukee & St. Paul Ry., White Bldg., Seattle, plans to enlarge its shops, here. R. J. Middleton, Asst. Ch. Engr.

W. Va., Parkersburg—The Seward Wire Co. awarded the contract for the construction of a 1 story addition to its plant. Estimated cost $40,000.

Wis., Milwaukee—The N. W. Motor Car Co., 2418 North Ave., is having plans prepared for the construction of a 2 story, 67 x 116 ft. garage. Estimated cost $150,000. Voelz & Siebert, 373 Bway., Archts.

Wis., Milwaukee—The Prime Mfg. Co., 653 Clinton St., awarded the contract for the construction of a 1 and 2 story, 82 x 160 ft. foundry on Clinton St. Noted Mar. 6.

Wis., Milwaukee—The Sterling Tool & Mfg. Co., 495 Bway., awarded the contract for the construction of a 1 story, 42 x 120 ft. machine shop on 30th St.

Wis., Milwaukee—Tharinger & Bruecker, Archts., 496 Cramer St., are receiving bids for the construction of a 2 story, 60 x 198 ft. garage on Windlake Ave. for the Tobin-Sutton Co., 636 Lincoln Ave. Estimated cost $150,000.

Wis., Sheboygan—The Garton Toy Co., North Water St. and Niagara Ave., awarded the contract for the construction of a 4 story, 60 x 90 ft. factory. Estimated cost $50,000.

Wis., Sheboygan—The Jenkins Machine Co., 315 North 8th St., awarded the contract for the construction of a 1 story, 40 x 90 ft. foundry and shop. Estimated cost $40,000. Noted Feb. 7.

Wis., South Milwaukee—The Line Material Co. awarded the contract for the construction of a 2 story, 60 x 185 ft. addition to its factory. Estimated cost $55,000.

Wis., Waukesha—The Quality Aluminum Casting Co., Lincoln Ave., is having plans prepared for the construction of a 1 story, 50 x 100 ft. addition to its factory. A. C. Pankratz, Mgr. Private plans.

Wis., West Bend—W. Warnkey, Main St., is having plans prepared for the construction of a 2 story, 34 x 72 ft. sheet metal working shop. Estimated cost $40,000. Federal Eng. Co., 444 Milwaukee St., Milwaukee, Engrs.

Wis., Wisconsin Rapids—The Nash Hardware Co., 2nd St. and Grand Ave., is having plans prepared for the construction of a 2 story, 86 x 110 ft. sheet metal and repair shop. A. F. Billmeyer, Wisconsin Rapids, Archt. Noted Mar. 20.

Ont., Peterboro—The Canadian Genl. Electric Co., 212 King St., W., Toronto, is having plans prepared for the construction of a 3 story addition to its factory, here. Estimated cost $400,000. Private plans.

Ont., St. Thomas—The Canadian Natl. Ry., c/o H. W. Matthews, Supt. St. Thomas Division, is having plans prepared and will receive bids about Apr. 15 for the construction of a roundhouse and machine shops. Estimated cost $220,000. S. H. Stone, 1 Toronto St., Toronto, Engr. Noted Mar. 13.

Que., Montreal—P. Labelle, 721 Dorchester St., W., plans to build a 4 story, 115 x 170 ft. garage on Bishop and Dorchester Sts. Estimated cost $150,000.